

Cowboys of the Sea

POPULAR MECHANICS

MAGAZINE

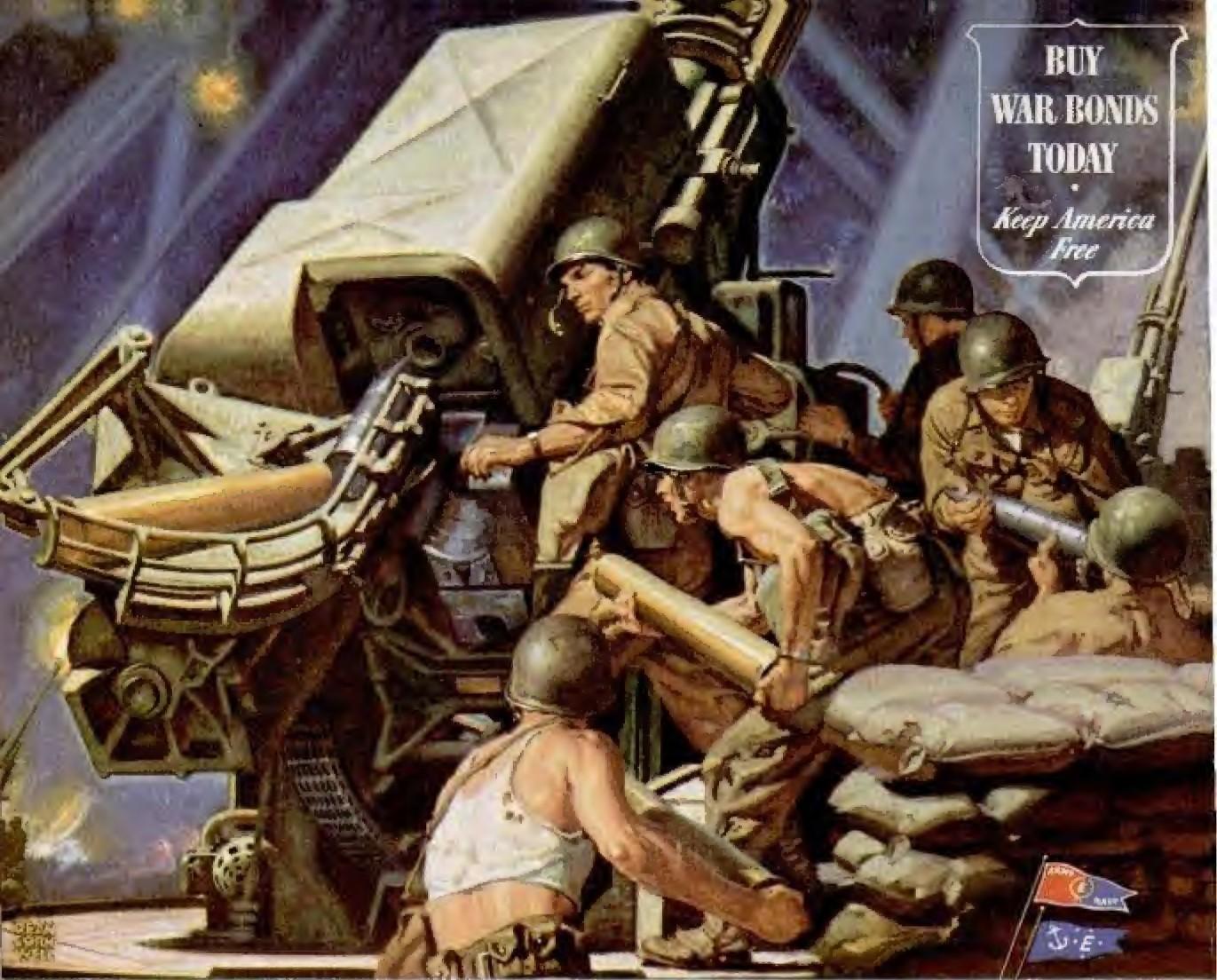
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SEE PAGE 82

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NO one had ever seen a gun like this three years ago.

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Once more, we were grateful for the Fisher skills and techniques that saw us through. The

The Army-Navy "E" flies above four Fisher Body plants for excellence in aircraft production and from two others for tank production, while the Navy "E," with five stars, is flown by still another Fisher Body plant for its naval ordnance work.

same Fisher Body craftsmanship that has turned out tanks, guns, bomber assemblies and other armament concentrated on this new puzzler—and came up with the right answers.

Our fighting men rate the best fighting tools in the world. We intend, now as always, to help give them whatever they need, and the best we know how to build.

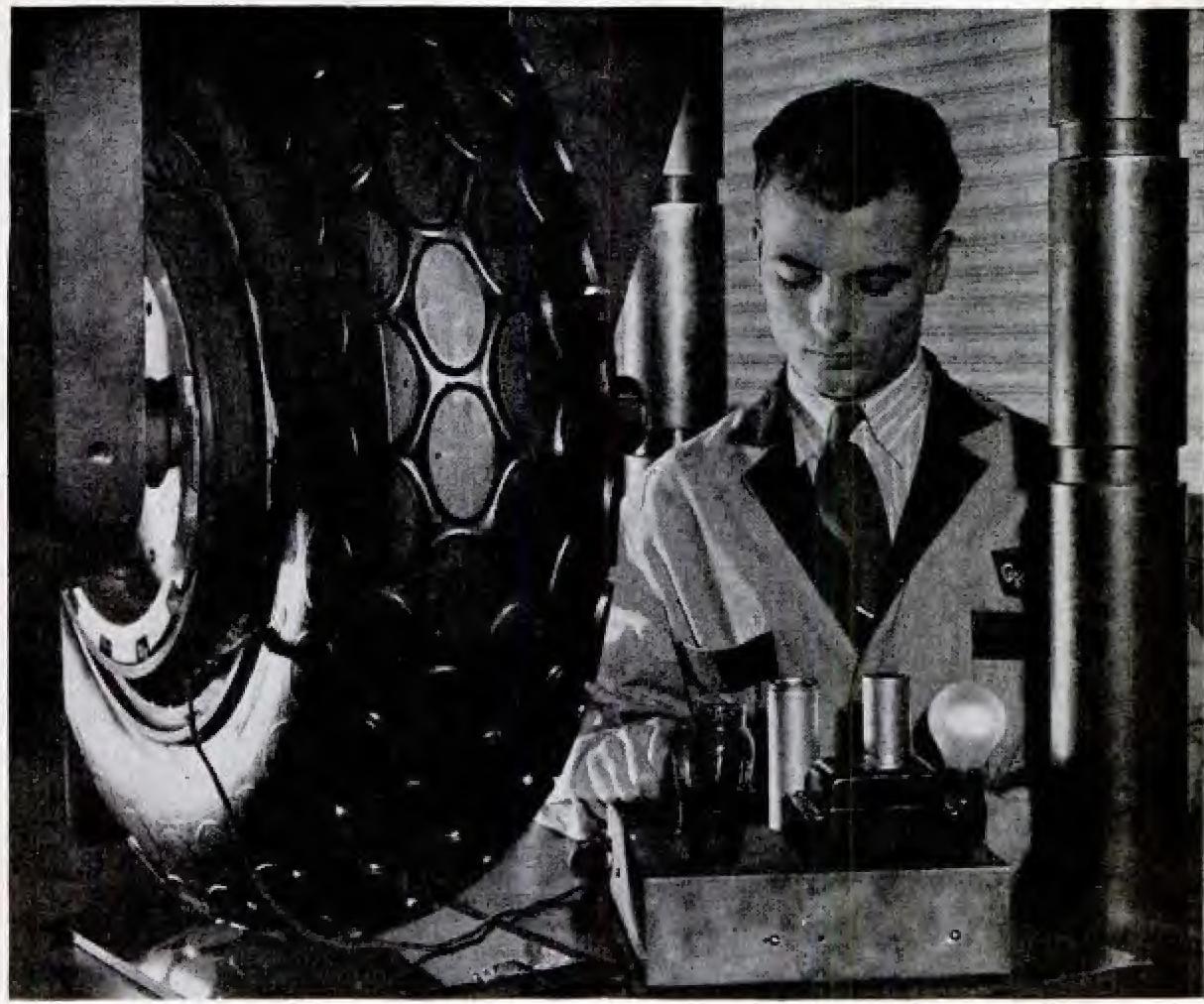
Every Sunday Afternoon
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armament
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The tire that lights an electric bulb

An illuminating development in rubber
that took the "shocks" out of flying

AN AIRPLANE in flight builds up a strong charge of static electricity, which once meant danger of sparks and fire—also danger of shock to passengers and crew.

The electricity would have passed harmlessly into the ground as soon as the plane's tires touched the earth if the rubber could conduct electricity. But rubber was an insulator; it prevented the electricity from leaving the plane. Could it be made into a conductor?

B. F. Goodrich engineers believed it could. They had already helped develop special carbon blacks to resist heat. Experiments were made with new ones to conduct electric-

ity. After many attempts, tires were built that can be placed in an electrical circuit and conduct the current into an electric bulb, as in the laboratory test shown above. And today, hundreds of airliners come to earth more safely on the new conductive tires.

B. F. Goodrich improvements in tires apply to every type of tire America uses—tires for planes, passenger cars, trucks, farm machinery. For passenger cars B. F. Goodrich made and sold tires containing synthetic rubber back in 1940, the first ever sold to American car owners and the only ones sold before the war. Their use by thousands

of people made up a road test estimated at over 80 million miles. Some of the tires are still running today, many without even being recapped.

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The "Weasel," built by Studebaker, is one more of those startling developments which have characterized American inventiveness throughout the war. Specially designed, in cooperation with Army Ordnance engineers, as a cargo and personnel carrier with the ability to negotiate terrain and surfaces impassable to other wheeled or tracked vehicles, it has already proved itself unequalled at such tasks in several theaters of war. Here, as in so

many of the highly specialized vehicles of war—tanks, trucks, jeeps, half-tracks, ducks and alligators—the essence of good performance is dependability. To have dependable performance, you must have dependable ignition. This is where dependable CHAMPION SPARK PLUGS play their vital part—why Champions are used in the "Weasel" as in engines of every size and type in the service of our armed forces on land, water and in the air.

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Popular Mechanics Magazine

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H. H. WINDSOR, Founder

H. H. WINDSOR, Jr., Editor and Publisher

November, 1944

Vol. 82, No. 5

Next Month

YOU won't have to consult a fortune teller to discover some of the things in store for your postwar home. Some of them, such as an infrared lamp for heating the bathroom or light rays for cooking, may sound revolutionary—but remember those folks who scoffed at horseless carriages and radio sets. Practical items like solar heating, frozen food lockers and parlor refrigerators (for cool drinks) will take their place alongside fluorescent lamps without wires, television sets, and germ-killing ultraviolet lamps. "Science Knocks at Your Door," in the December issue, tells all about it.

Trouble Shooters

WHEN our first long range fighters reached England their radios acted up like they were besieged by Nazi-inspired gremlins. Experts tore their hair and ripped electrical systems apart, but to no avail. An SOS was sent to the First Radio Squadron, Air Service Command, at Patterson Field. A December feature, "Radio Trouble Shooters With Wings," tells how this mystery and scores of others were solved.

Why Leave Home?

WITH the ends of the earth as close as the electronic switch at your elbow, there won't be much excuse for leaving home if radio communication engineers have their way. You can sit at home and watch Johnny running in the Olympics, send a check or photo to Zanzibar. Television, facsimile and radio-photos give you "The World at Your Elbow," a December feature.

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Living Test Tubes

CHANCES are you never heard of Penn State Jessie—a cow who lived in a college laboratory with a window in her stomach. She should be more famous than Elsie, for she gave the world much of its knowledge of Vitamin B. And did you know that bats have been using a supersonic device like radar for a million years so they can fly at high speed in darkness through dense foliage without brushing a leaf? Drowning ducks helped produce a liquid wetter than water, and it was a thirsty dog who helped solve the mystery of diabetes. Read the story in the December issue.

"Battling Baby Carriages"

THESE so-called "baby carriages" cost 11 million dollars apiece and are better known as baby flattops. The midget seagoing airports are today the most numerous type of large-sized warships. They fought subs in the Atlantic and their Pacific prey is the Jap torpedo or bombing plane. "Life on a Baby Flattop," as told in an outstanding article next month, is in a class by itself with a lifetime of danger packed into breath-taking 10-second intervals. Here's something new in naval warfare.

Published monthly by POPULAR MECHANICS COMPANY, 200 East Ontario Street, Chicago (11), Ill., U. S. A. Single copy in the United States, 25 cents; subscription rates in United States and possessions, and countries of the Pan-American Postal Union, 1 year, \$1.50; 2 years, \$4.50; 3 years, \$6.00. Single copy in Canada, 30 cents; subscription rates, 1 year, \$3.00; 2 years, \$5.50; 3 years, \$7.50. To all other countries add \$1.00 a year over United States prices for overseas postage. If you plan to move, notify us at least 60 days in advance so you will not miss an issue. Give both old and new addresses. Entered as Second Class Matter, September 15, 1903, at the Post Office at Chicago, Illinois, under Act of March 3, 1879. Entered as Second Class Matter at Post Office Dept., Canada. Copyright 1944, by Popular Mechanics Company. Copyright under International Copyright Union. All rights reserved under Pan American Copyright Union. Printed in the United States of America



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you ever touched a match to. Telescoping case makes two handy utensils. Ready in minutes for cooking, heating drinks, purifying water. It's the outdoor stove of tomorrow. Every hunter, fisherman, camper will want it. Grand for backyard picnics, too—and for hundreds of uses around the home.

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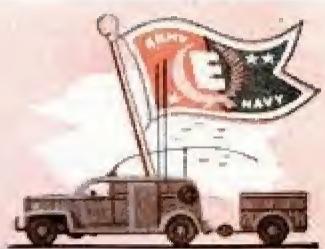
out and brings in high quality reception from the most obscure and distant points.

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Photography meant nothing to Bill Brown ten years ago. His interests were boating and his daughter Diana. Once in a while he'd blow the dust off an old box-type camera and snap a stilted photo like this.



Diana finally rebelled—and one Christmas gave her dad a Universal candid-type camera and a subscription to a photo magazine. Soon Bill was taking shots like this of Diana in her first evening dress.



Bill was really bitten by the photography "bug," and fixed up this dark room in the basement. He gradually accumulated a full line of equipment—topping it off with the Universal Micrographic Enlarger.



This one won a prize at the local Photo Club exhibition. A sharp action shot, it shows how Bill had developed as a photographer. But Bill gave credit to his Mercury—one of the fastest cameras made.



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place as a stepping stone to top executive positions or to a profitable business of your own, and how you can train for it.

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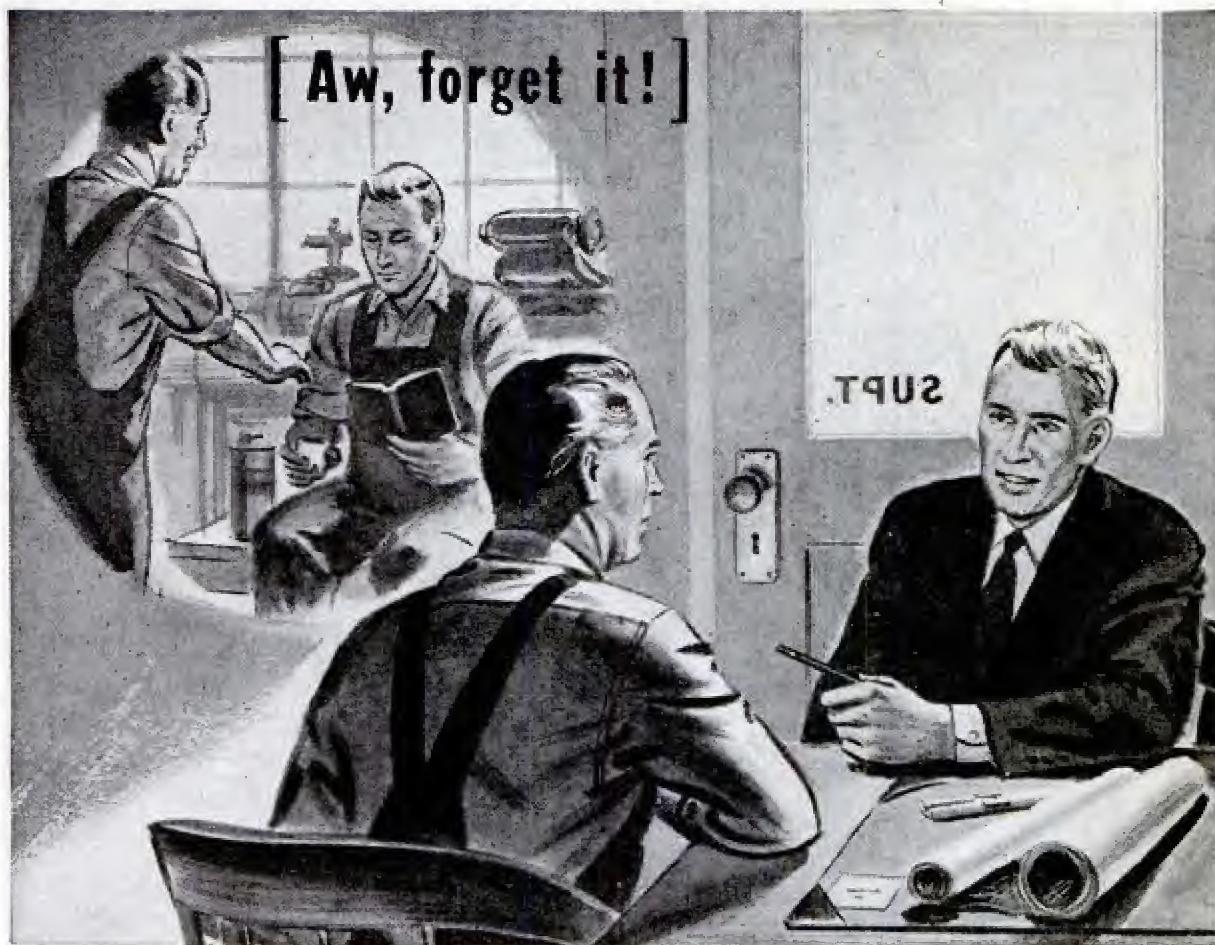
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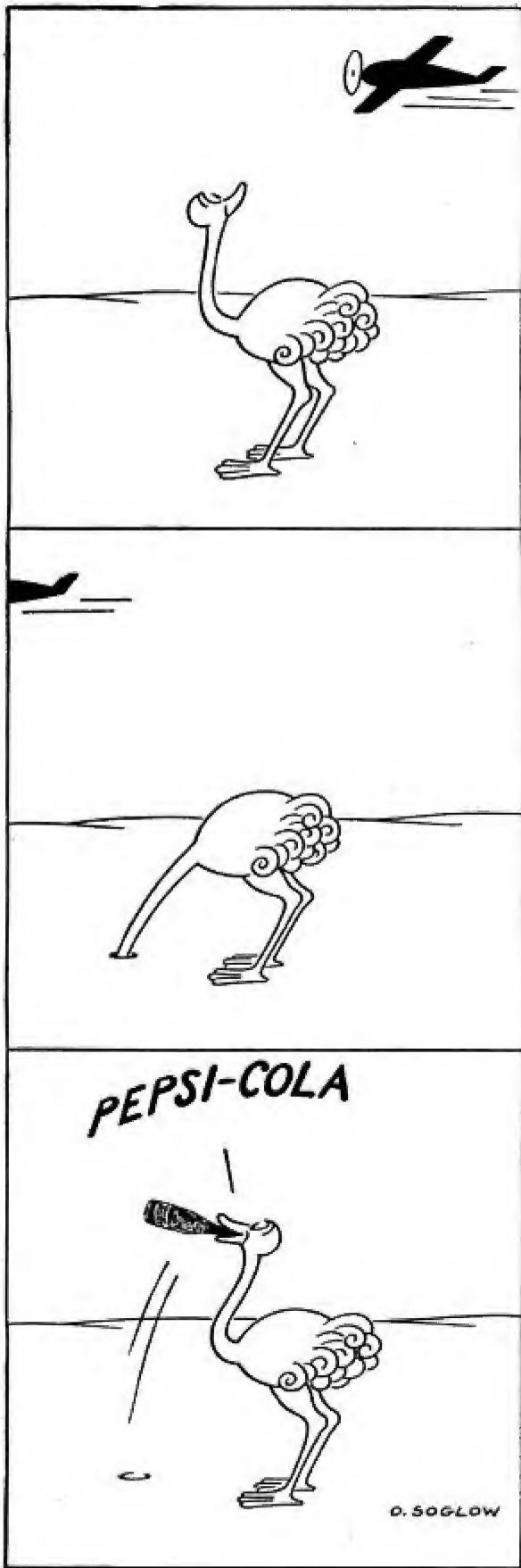
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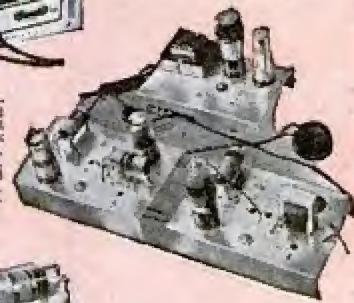
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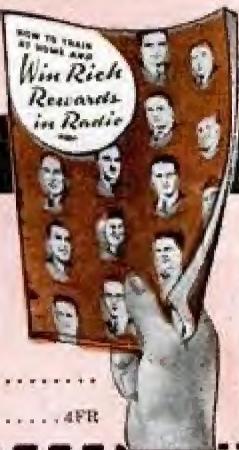
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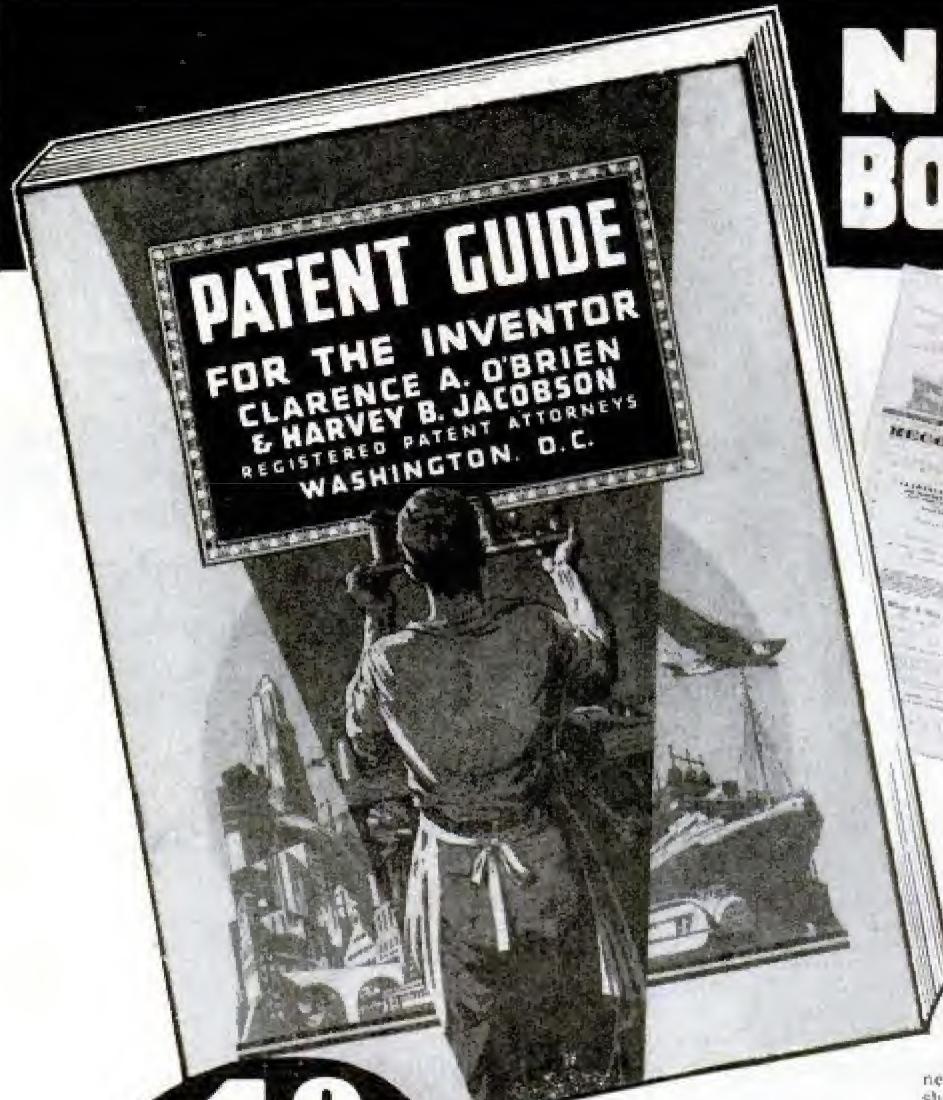
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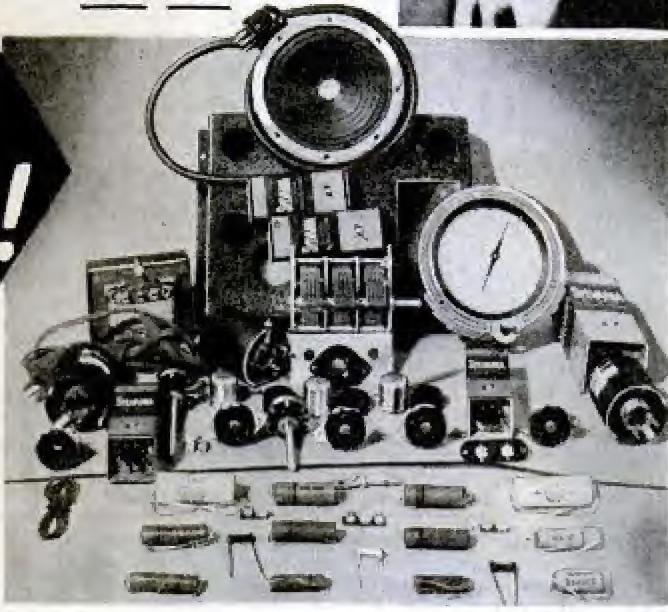
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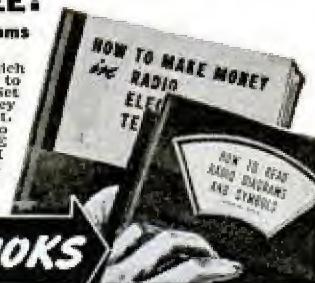


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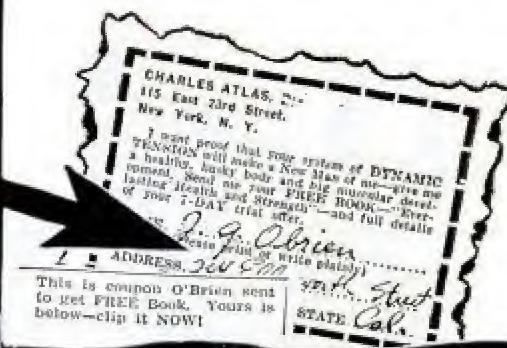
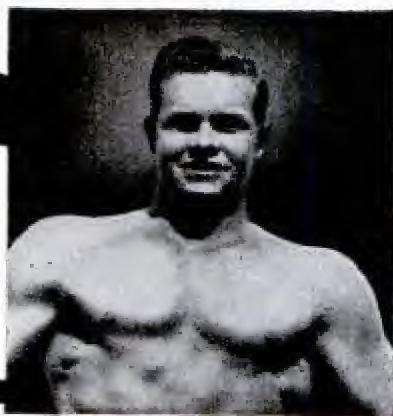
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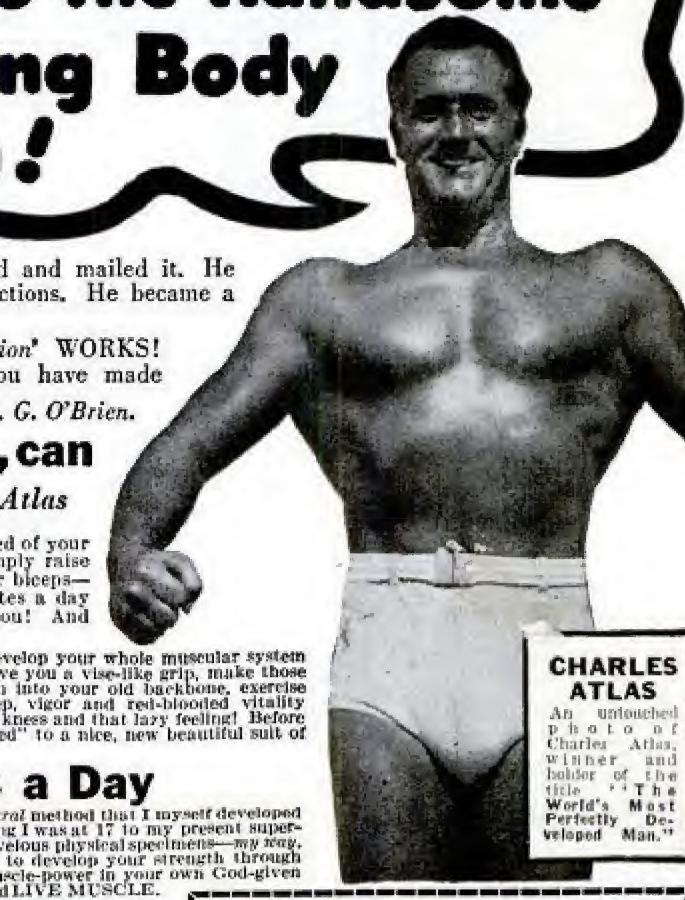
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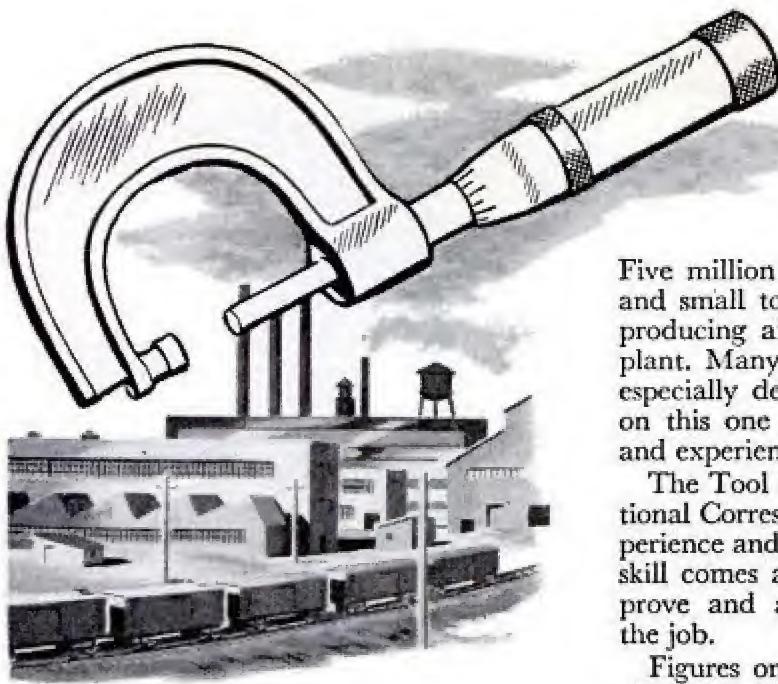
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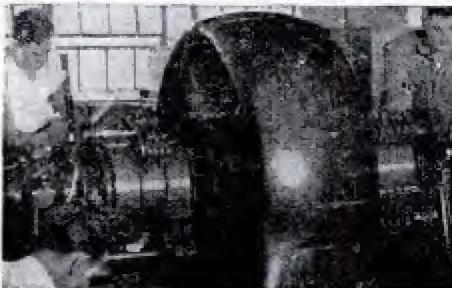
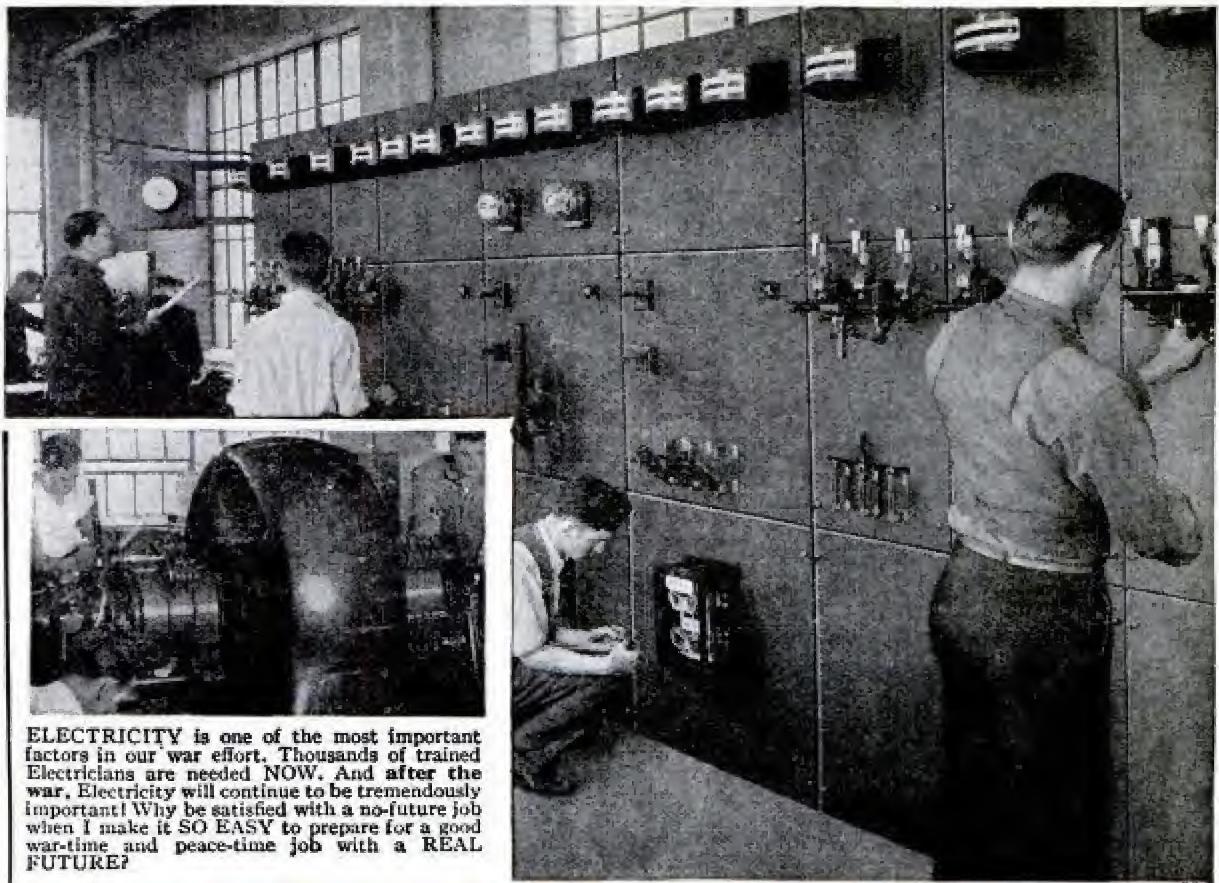
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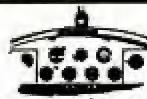
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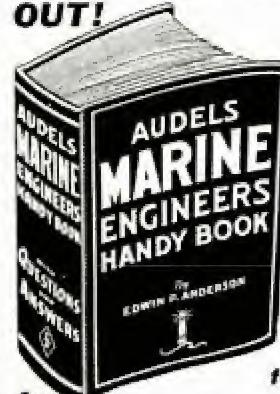
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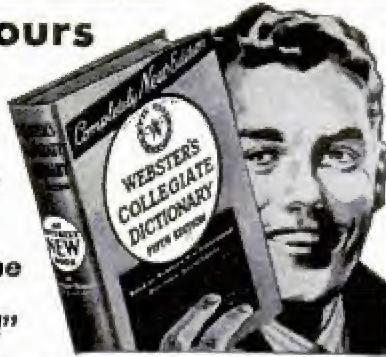
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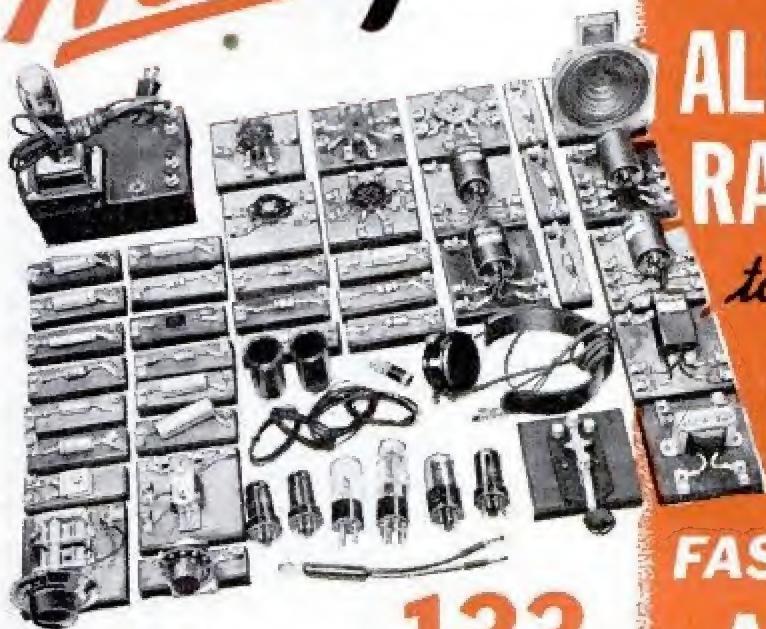
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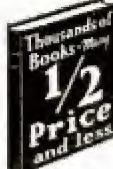
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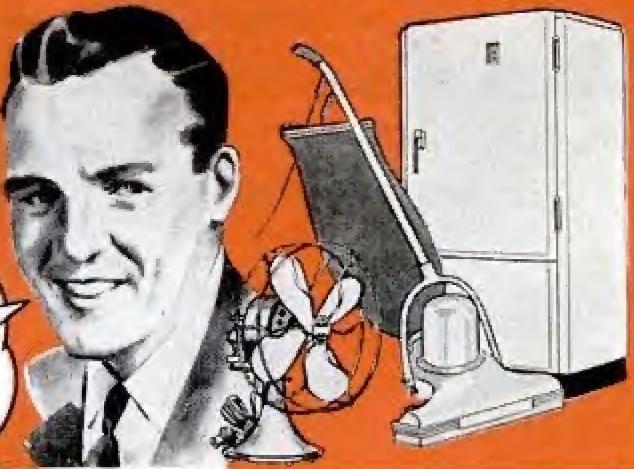
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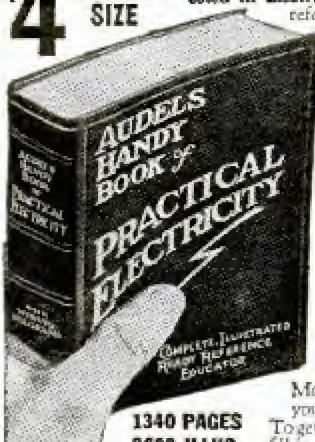
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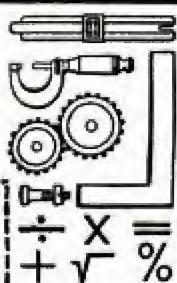
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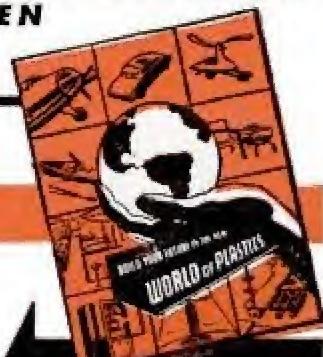
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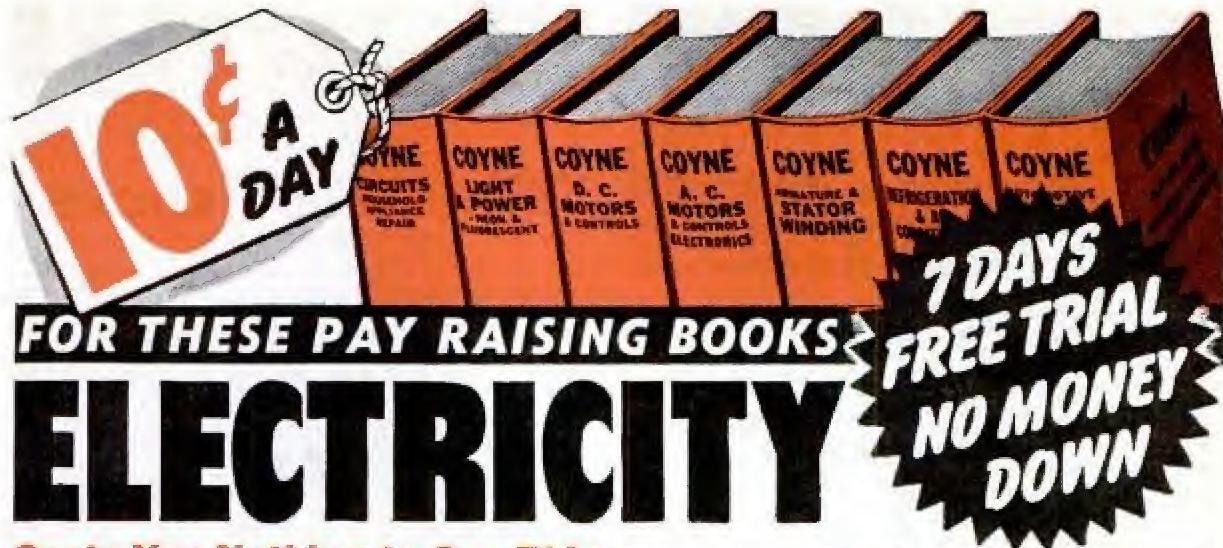


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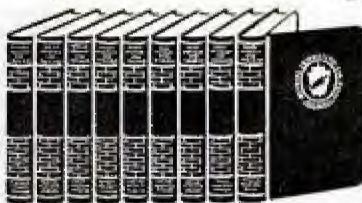
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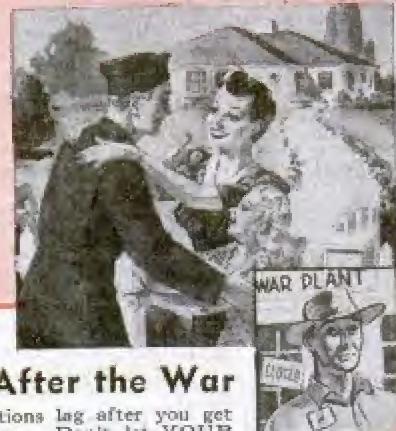
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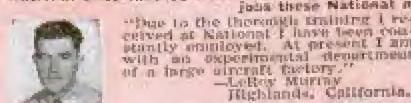


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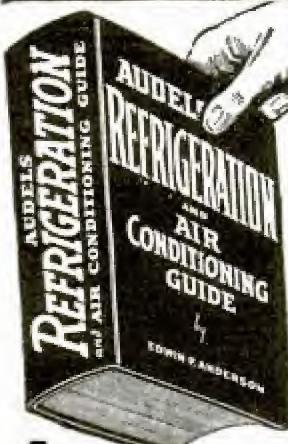
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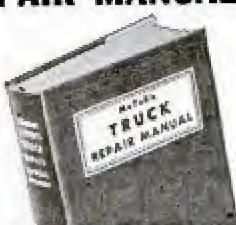
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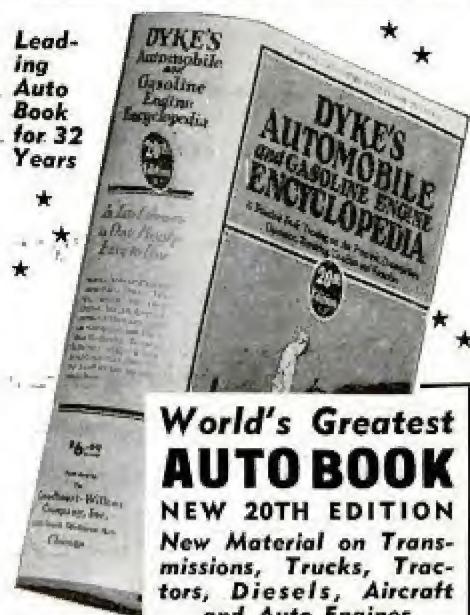
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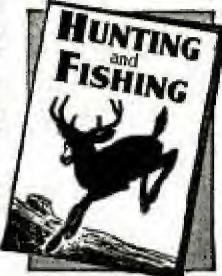
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FREE! Send negative, this ad for beautiful 4x6 enlargement. (Stamp appreciated). 16 sparkling prints. 2 Hollywood enlargements from roll or negatives. 25¢. Lifetone Studios, Dept. A-939, Des Moines, Iowa.

SENSATIONAL Introductory offer! Send snapshot or negative, this ad, and 3¢. We'll send you a beautiful 7" x 5" enlargement! Or, Kodak roll developed with 16 guaranteed deckled-edge Velox fadeproof prints or 8 double-size prints, 25¢! Special! From your negatives, 16 regular-size or 8 double-size reprints, 25¢! Candid rolls—36 exp., 35mm, developed, vaporated, enlarged to 3x4, \$1.00! 18 exp. 60¢. Reprints, 3x4, 3¢ each. We have new, perfect 35mm film. Low prices. Free mailers, details on request. American Studios, Dept. 413, LaCrosse, Wis.

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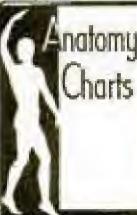
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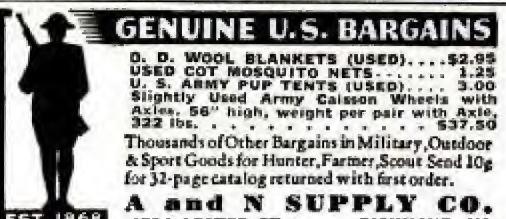
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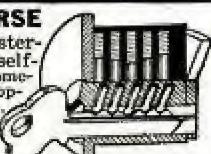
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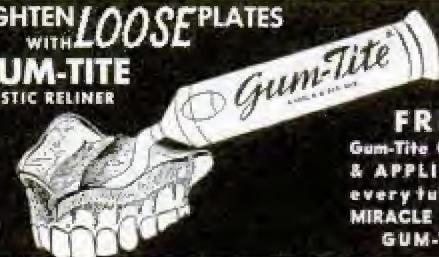
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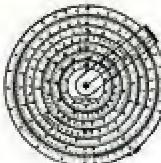


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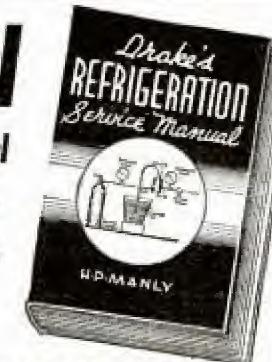
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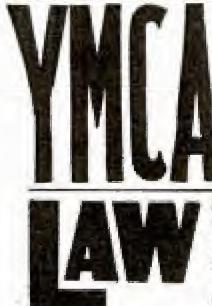
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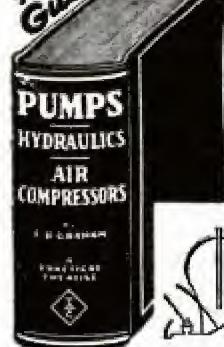
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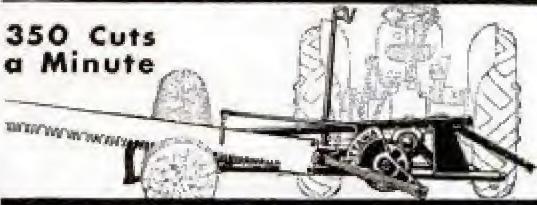
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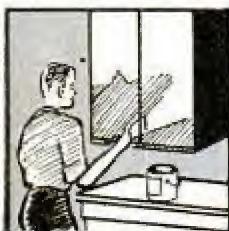
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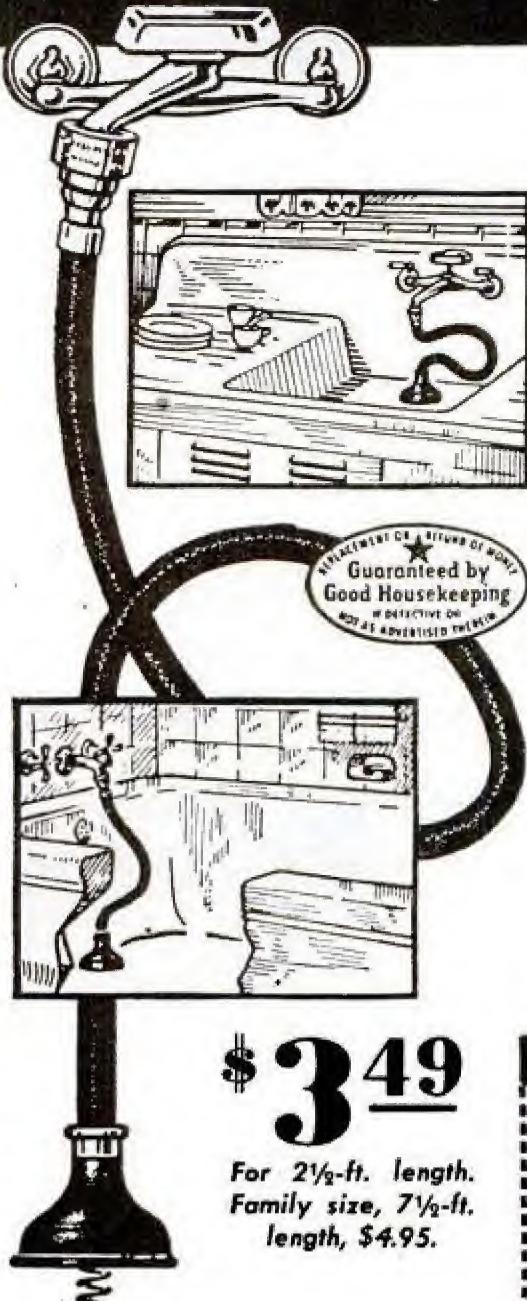
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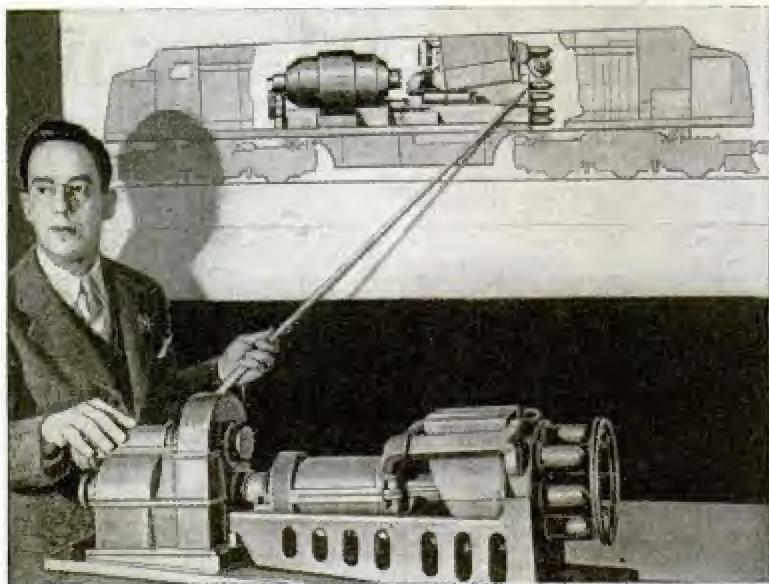


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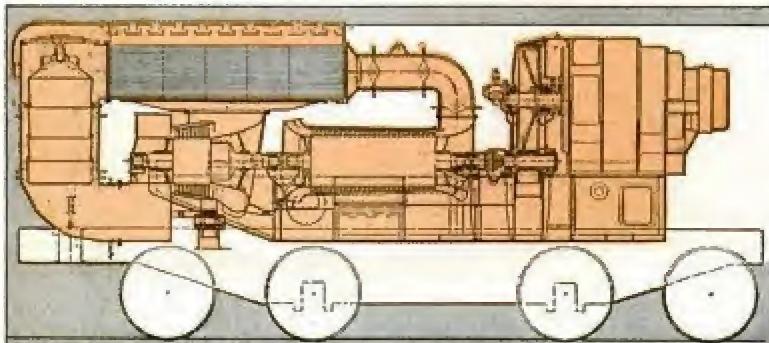
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The gas turbine is a kind of multiple windmill enclosed in a steel cylinder. Compressed air and fuel—low-priced gas or oil—are forced into a chamber to provide combustion under pressure. The products then are blown through a nozzle at great speed so as to spin the "windmill," part of whose power drives the combustion-cham-



Above, phantom drawing of a locomotive and model of a marine gas turbine are shown as two promising fields for application of the engine



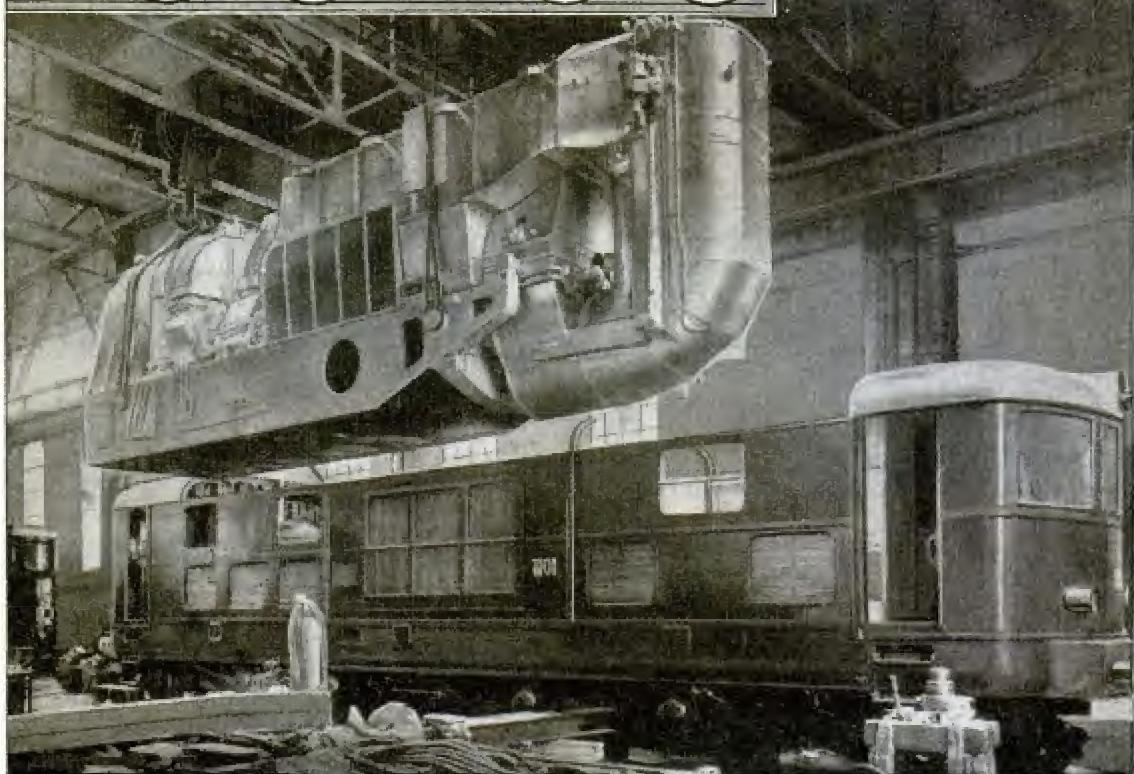
ber compressor. The remainder is the net power derived from the flaming gases. This power can be either harnessed directly to machinery or used to drive a generator for the production of electricity.

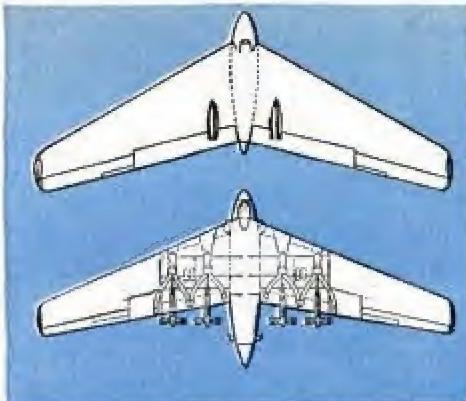
Sometimes the "hot hurricane" occurs incidentally to another process, as in the case of aircraft exhaust gases to run turbo-superchargers, which are simple gas turbines. But the important characteristic is that the turbine wheel is spun by the direct blast of the burning fuel unlike the steam turbine wheel, which is turned by steam blown from an elaborate, complicated boiler.

In its simplest form, nearly three quarters of the total power produced

Left, diagram of locomotive shows combustion chamber at extreme left, a gas turbine above wheel at extreme left, and generator at right. Below, gas turbines and generator are lowered into a locomotive hull

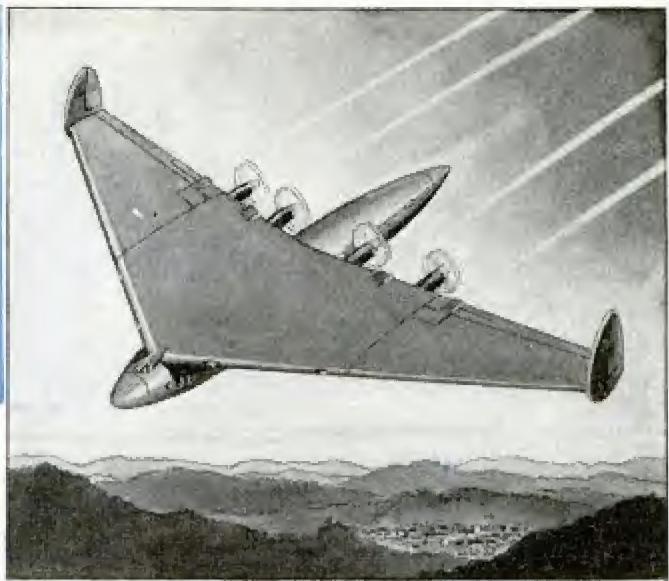
Courtesy of Diesel Progress





Courtesy of Aviation News and The Aeroplane
Top, sketch of a proposed jet-propelled mail plane. Bottom, plane whose gas turbines drive contra-rotating propellers (artist's conception of it is at the right)

in the gas turbine is consumed by the compressor which feeds the turbine and the one quarter left as net power to do useful work is relatively less than with other forms of power-producing machinery. Both Diesel engines and ordinary gasoline engines can be made to produce even more power from the same

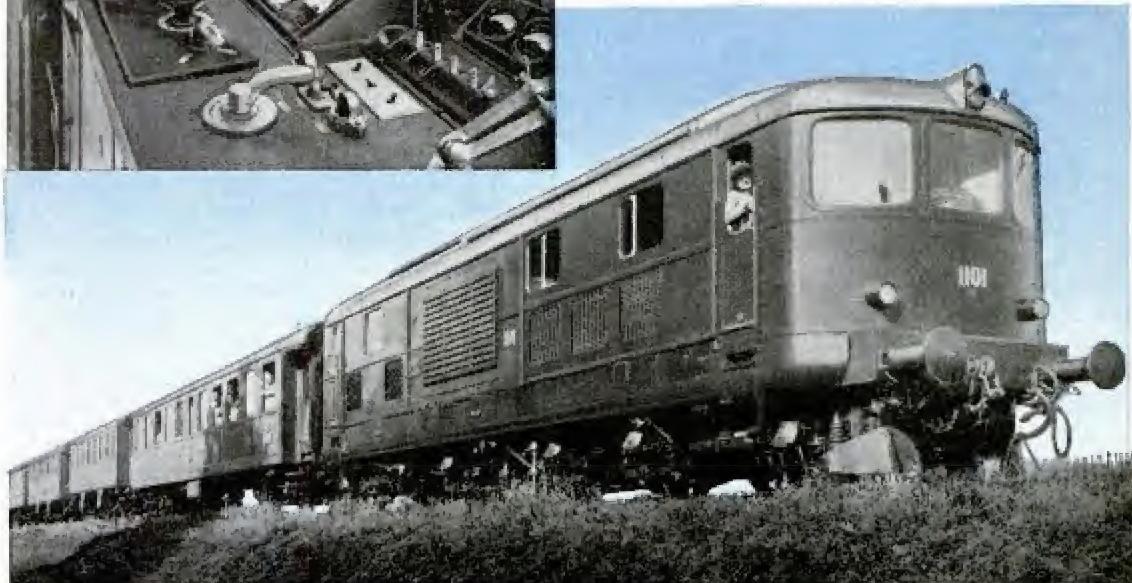


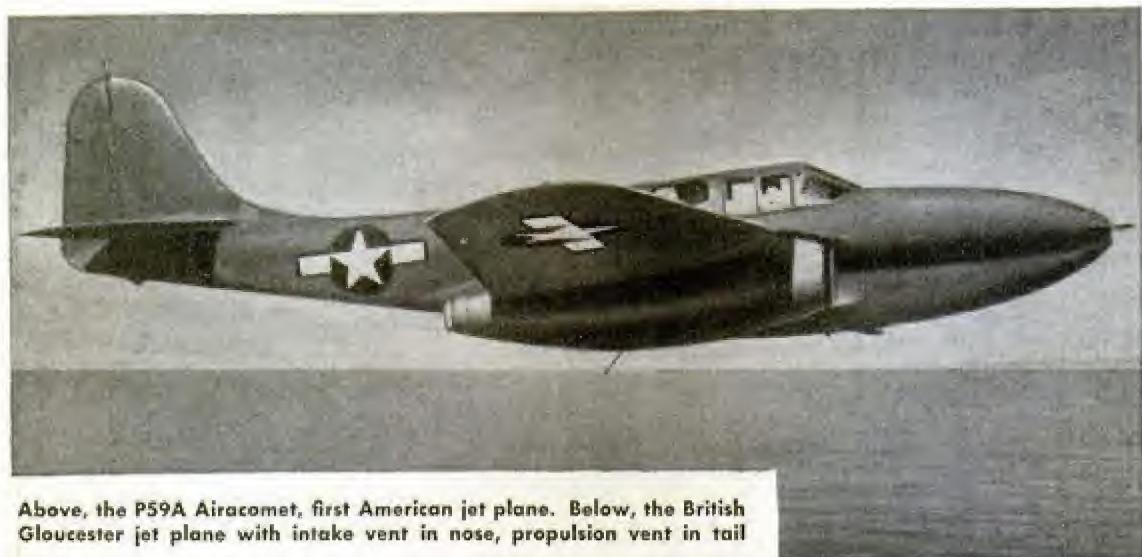
amount of fuel but, despite its present inefficiency, the gas turbine has advantages in weight, space, and reliability if used to drive locomotives, ships and aircraft.

On that score the gas turbine does away with the boilers and large-size condensers needed for steam turbines and the complex, heavy cooling systems and multitude of accessories required by gasoline and Diesel power plants. The type of fuel it can use also may make it much less costly.

One of the most interesting things about this prime mover is that its efficiency soars upward at a rate three times as great as for steam for each internal temperature jump. At the same time compressor efficiency improves as the external temperature drops. Think of what this means to aviation. It

Left, engineer's room of gas turbine locomotive (below) built by Brown, Boveri for Swiss railways





Above, the P59A Airacomet, first American jet plane. Below, the British Gloucester jet plane with intake vent in nose, propulsion vent in tail



may make possible really large and fast planes which can operate satisfactorily at 50,000 feet or more. Thus far it has been applied with apparent success in the fantastic jet propulsion plane, a propellerless craft which uses kerosene or some other cheap fuel and can travel approximately 100 miles per hour faster than any conventional aircraft. In this version the turbine wheel uses only enough power to operate the supercharger. The exhaust gas, still under pressure, jets out at high velocity through a rear nozzle. The sustained high-speed flow of exhaust gas provides the thrust that moves the plane forward.

Many engineers say the usefulness of the aircraft gas turbine will begin where the gasoline-driven engine, with its high-octane fuels, ends. The latter is now so overgrown in size and complexity that it does not seem practical to push it to much more than 2,000 horsepower; in addition, propeller efficiency falls off considerably at around 400 miles per hour, when the speed of the propeller tips begins to approach the speed of sound, and at altitudes of 35,000 to 40,000 feet.

Recently it was announced that gas-turbine-powered warplanes are already in the air, thanks to the discovery of a certain

combination of "vitamin alloys" that, added to steel, result in a material able to withstand the very high temperatures needed for efficient operation. The War Department also announced significantly that it had requested General Electric to devote 600,000 square feet of floor space to the manufacture of gas turbines.

If adapted to locomotives, the gas turbine can offer very low track wear (due to smooth power flow), low lubrication and maintenance costs, full braking power, large starting pull and longer life. Some turbine designers assert it will duplicate the desirable operating characteristics of the Diesel electric—no water stops, fast acceleration, and no track pound—while remaining as cheap, or cheaper, to run than the steam engine.

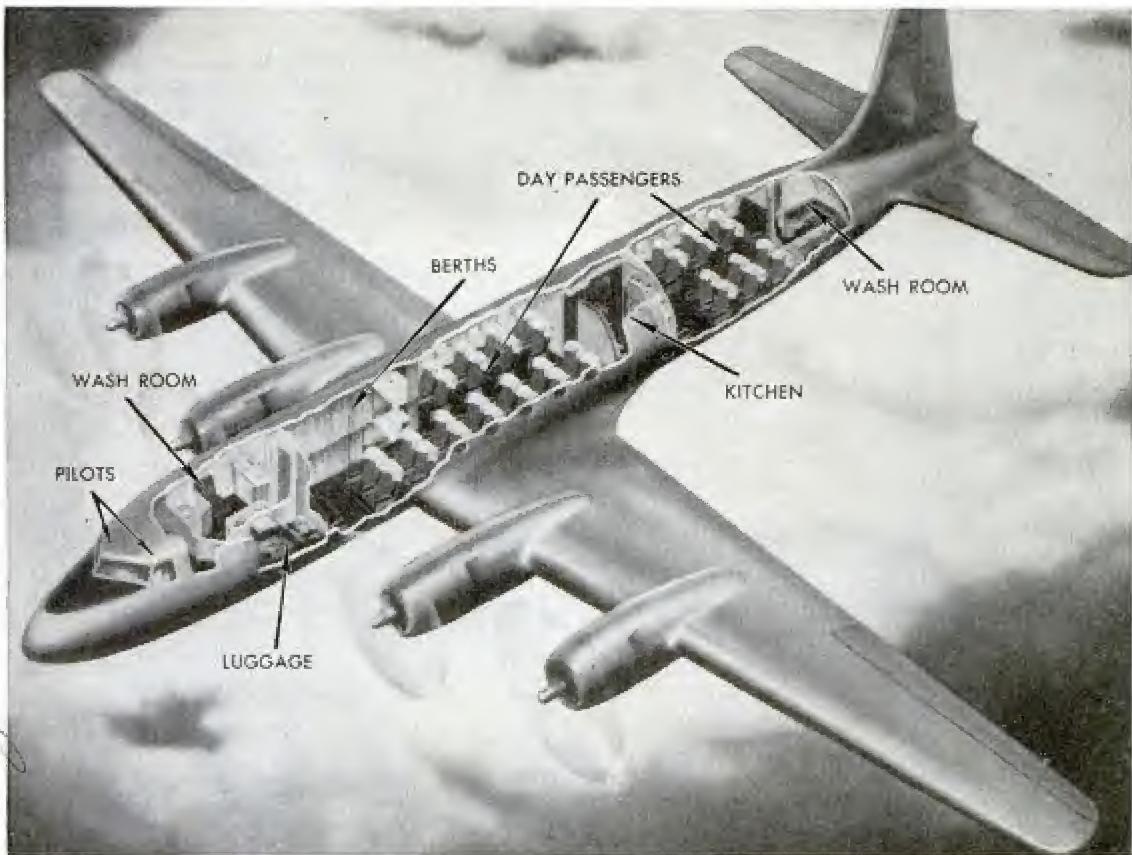
A 2,200-horsepower gas turbine locomotive built in 1939 by Brown, Boveri of Switzerland proved successful as an experimental model. In this country Allis-Chalmers, Westinghouse and General Electric are planning models which will be tried out in peacetime. General Electric is studying plans for a gas-turbine-powered locomotive with 4,500 horsepower but only 75 feet long—about half the length of a Diesel electric.

In ships, as in locomotives, the gas turbine's advantage is that it has no boiler to take up valuable cargo or passenger space and it needs no heavy condenser or bulky apparatus for distilling feed water. Including its drive mechanism, it is estimated the marine gas turbine will weigh only about

(Continued to page 162)

0544

DeLuxe Postwar Planes to Set Speed Records



Death Menaced, Cab. 2

When the big sisters of the two-engine DC-3, the familiar 21-passenger prewar airliner, go into service after the war they will have an increased speed of 25 percent and nonstop range will be more than 3,000 miles. Major air lines have placed orders for more than a hundred of the new transports which will be built by the Douglas Aircraft Co. They are the DC-4, a peace-time version of the combat-transport C-54 used by the Army and Navy to fly cargo all over the world, and the DC-6. Both are four-engine planes. The DC-4 is powered by Pratt & Whitney engines of 1,450 horsepower each, and the DC-6 has 2,100-horsepower engines of the same make. The DC-4 will carry 44 passengers, the DC-6 fifty.

Both transports have a five-man crew. The DC-6 can be converted to a sleeper plane with accommodations for 24 sleeper and two sitting up passengers. This plane will also have a pressurized cabin so that it can fly "above the weather" on long hops. Maximum cruising speed of the DC-6 is 334 miles an hour at 23,800 feet with a gross weight of 63,500 pounds. At 10,000 feet the DC-6 has a cruising speed of 278 miles an hour compared with 239 for the DC-4 at the same altitude. Both have stalling speeds of only 80 miles per hour. The planes will look much alike, with identical wing span of 117 feet, six inches. The DC-6 is 100 feet, seven inches long, about seven feet longer than its sister ship.

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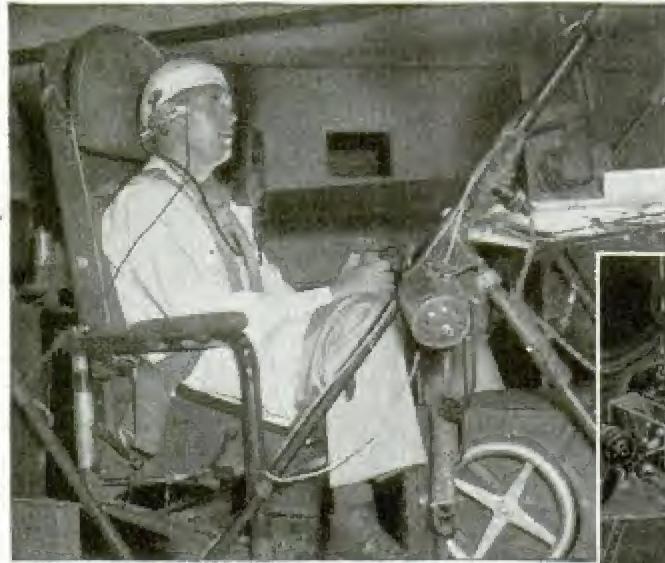
Chemical Makes Softwoods Hard and Protects Them From Humidity

Woods are made markedly harder, stronger, stiffer and more durable by means of a chemical development at the E. I. du Pont de Nemours Co. The chemical agent, methylolurea, is obtained by compounding urea with dimethylolurea, both of which are inexpensive and available commercially. Through treatment soft woods become harder than hard maple and maple wood is made harder than ebony.

In addition, the process eliminates the natural tendency of wood to swell, shrink or warp with humidity changes. Furniture made of the transmuted wood could be shipped to any spot on the globe and still remain in condition. Color can be imparted permanently by the use of dyes in the impregnating material. The treatment also may be used to harden the outside of lumber without affecting the interior.

O 4/1

Man Spins Like Pail on a Rope in Blackout Test



Left, Air Force corporal, wearing a molded brain-wave recorder, prepares for a test blackout run. Below, a technician sits next to centrifuge pivot shaft as an observer. She talks to control room



Diving blackout, the temporary loss of perception by pilots during violent flight maneuvers, is being studied by means of a special centrifuge machine in the Air Force's experimental laboratories at Wright Field, Ohio. The centrifuge, which resembles a two-arm merry-go-round with a man-carrying cab or cockpit at the end of each arm, is spun by a 250-horse-power electric motor. The volunteer test subject sits in one cab with the observer facing him. When the centrifuge is started, the cab swings outward like a pail on the end of a rope. The motion thus duplicates the force of an airplane pulling out of a dive—the maneuver which causes a black-

out. The force can be lessened or increased by varying the speed of the centrifuge. Special instruments, such as an electrocardiograph, brain wave recorder, and photo electric eye for measuring blood volume in tissues and to take pulse and respiration, record the subject's reactions.

O 4/9 7 Postwar Bus Has B-24 Nose and Airplane-Type Engine

When the first postwar bus rolls off the assembly line at a Consolidated Vultee Aircraft plant, it will bear both exterior and interior resemblance to the Liberator bomber built by that company. The driver's compartment, resembling the nose of a B-24, is almost entirely surrounded by

transparent plastics. An air cooled engine will be used in the first attempt to adapt aviation engines to highway transportation. This is one of two types of postwar buses designed for the Greyhound company. The other, of similar exterior design, will be built by General Motors and powered by Diesel engines. They will carry 50 passengers, nine more than the most modern prewar Greyhound bus, in three compartments on two levels. One compartment, which affords toilet facilities, may also include sleeping space or a smoking lounge. Engines on both types of buses may be detached easily for maintenance or repair.

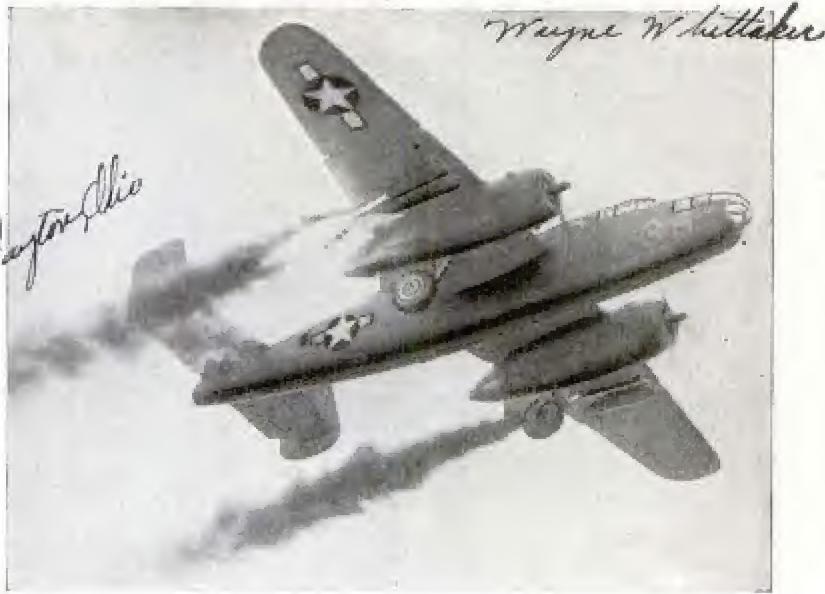


0494

Rockets 'Shoot' Army and Navy Planes Into Air

Rocket power has been harnessed by the Army and Navy to assist bombers, carrier planes and flying boats into the air from short runways. Two types of rocket takeoff units developed at Wright Field, research center for the Army Air Forces, are the fixed and droppable. The fixed type, adaptable to combat planes, has a nozzle which emits gaseous flames from the rear of the engine nacelle. Heavier planes can be equipped with droppable rockets attached to the under side of the wings. A major problem in the development of the rocket unit was to find a nozzle that would stand the terrific heat of the ignited gas. The rocket units used by the Navy, known as "Jato," for "jet-assisted takeoff," resemble bombs and are attached to the fuselage. They are ignited by spark plugs, and the plane receives its "thrust" from an escaping stream of white gas.

Army bomber (top) takes off from a short runway with rocket units under wings. Navy plane (right) has fuselage attachment



Plastic Film "Copies" Surface to Magnify 10,000 Times



With a small projector, a strip of transparent plastic, and a special solvent, an enlargement similar to costly photomicrographic processes can be obtained in a few minutes. When the "homemade" slides are projected on a screen they produce an enlargement of 10,000 times in area with a three-dimensional effect. This non-photographic process can be used on any type of surface from a plant leaf to a metal finish. First, the surface to be studied is wet with the solvent. Then a one-inch strip of the plastic film is pressed to the surface for about a minute. The film is peeled off and inserted in a handy paper frame.

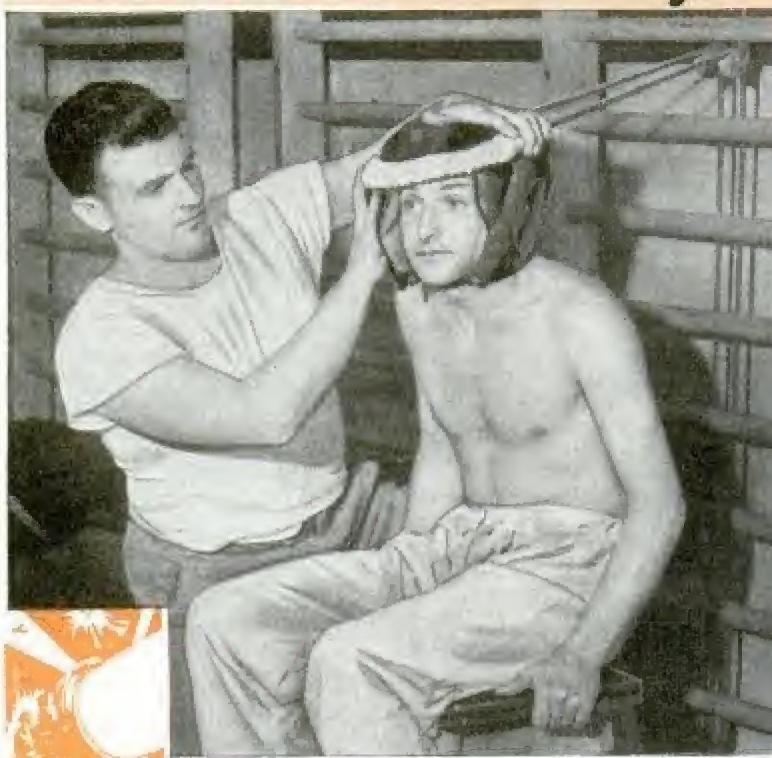
NOVEMBER, 1944

Mr. Lee J. McDill
5109 Mayfield Rd.
Cleveland 31, Ohio

Mr. Allen Warren & Heath
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N. Y., 16, N. Y.

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REPAIR SHOP for HEROES



Helmet (left) protects head as patient exercises wounded neck by stretching elastic cord. Ankle exerciser below works out kinks in foot and lower leg



THOUSANDS of wounded soldiers who would have been classed as hopelessly unfit for further combat are coming back today, "fighting fit," ready and willing.

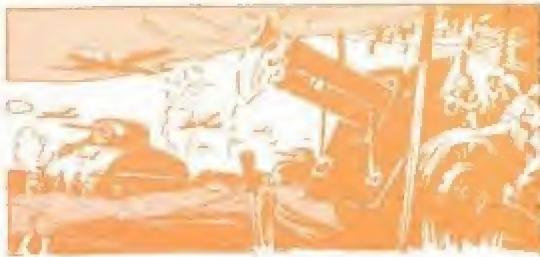
These wounded heroes are being treated by the best methods of reconditioning and the most modern apparatus American ingenuity could devise, in army hospitals that are scientific body repair shops.

Typical is the \$12,000,000 Halloran General Hospital on Staten Island, New York City; it is one of the biggest army hospitals in the world, accommodating more than 3,000 soldiers in its 100 or more buildings scattered over 383 acres of woodland.

Through the proper blend of medical treatment and hobbies—physiotherapy, hydrotherapy, electrotherapy combined with occupational and recreational therapy—the wounded soldier has an opportunity as he recuperates to do something he enjoys—something which at the same time teaches wasted



Hand-over-hand exercise turning wheel to which tension is applied helps patients learn to raise their arms again



and hampered muscles and nerves to go back to work.

It starts in the great wards of the hospital when these soldier-patients are well enough along in convalescence to take an interest in something besides their physical condition.

Usually they are started off holding something with their hands. It might be a simple object which they can finger. It might be a book or a magazine. It might be an airplane recognition chart which they hold, while tiny model planes flash past the foot of their beds on wires. Some tie fishing flies. Other husky G. I.'s find themselves weaving insignia patches, camouflage tape, and liking it.

When the day comes that they can push themselves along in a wheel chair, a variety of special tools and work benches is available to them, each prescribed with a specific purpose.

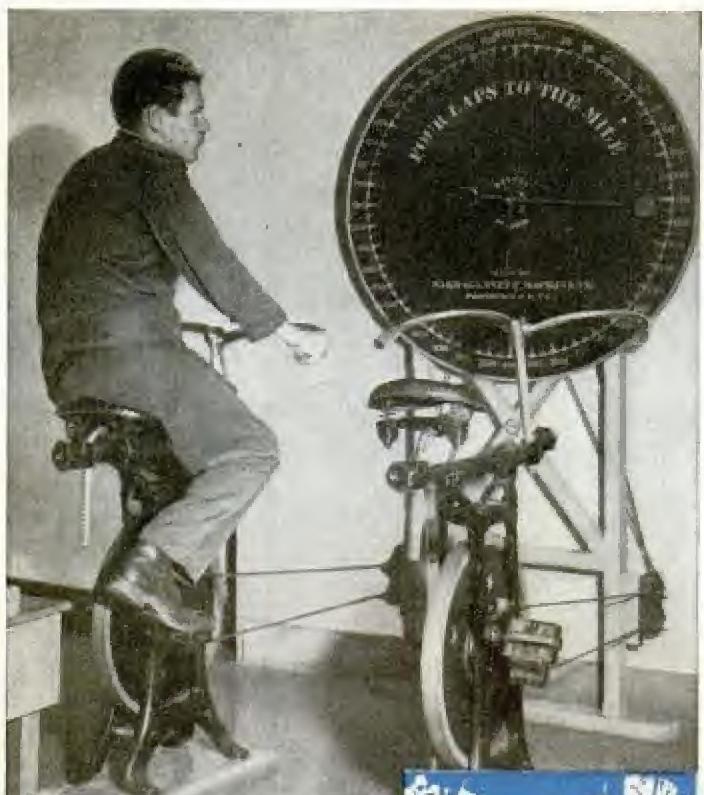
Reconditioning may start in a nerve-tingling tonic shower, where a hose directed by a physical therapy aide plays alternate

Stainless steel hydrotherapy tub is used to increase circulation and warm injured parts. With weight reduced by immersion, first exercise of legs is made easier

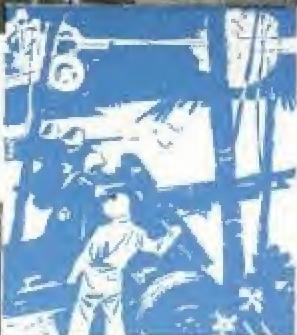


Motor is removed from lathe and foot-power substituted to strengthen leg





The stationary bicycle is a standard exerciser. To restore upper leg muscles to usefulness, veteran thrusts foot against a weighted cord. Weights are added as muscles gain



streams of hot and cold water against the body. Or in a fast whirlpool of hot water in which mending arms and legs can relax. Or in a shallow stainless-steel tub where the body's weight is relieved by immersion in hot water and the first exercises of incapacitated limbs can be taken with ease.

Heat and motion are the benefits of hydrotherapy. Together they restore circulation. For the same purpose diathermy, ultraviolet and heat instruments are available.

Then begins the real trip into "Therapy-land" at Halloran hospital. Adjustable "walkers" on wheels permit them to take their first steps. Stairways that lead nowhere—except to health—revive an old familiar function of the legs. "Finger ladders" with notches up which the digits climb one over another begin restoration of the use of the fingers. Molds which guide the fingers are used for the first finger movements. Ankle exercisers on springs permit feet to be rocked back and forth for the first time.

A circular, wheel-like, turning board with a single handle is rolled little by little as a tightened shoulder gradually limbers up until the day comes when the board can be turned in a complete circle. It is then that shoulder muscles are free.

A stationary bicycle with a registering dial loosens up legs as the "distance traveled" is increased by prescription. An arrangement of three mirrors helps men learn again how to swing their heads and exercise their necks.

After their muscles and nerves have "graduated" from physiotherapy, the soldier patients are often sent to occupational therapy buildings where the education of their muscles and nerves continues. The tasks here, however, are not only pleasant, but useful. Book ends, filing cabinets, tables, rugs, miniature models and a wide variety of craftsman articles flow from the shop. Men who need ankle work will rock a sewing machine treadle, others who need leg work will pedal a bicycle-gearied lathe or saw.

Shoulders are educated at rug-weaving frames, fingers at rope-weaving racks, backs at cord-knotting stands. Arms are taught to raise and pull at leather presses. Wrists get limber at small sawing jobs.

Sandpapering has been found excellent for knotted fingers and hand muscles which must be retaught to grip. A wide variety of sanding

blocks provides one which will fit the needs of any disabled hand. Wads of modeling wax are manipulated in the first stage of limbering.

A bit more recreational is a game of "muscle checkers" available in the workshops. The board is larger than standard and the checkers are tapered pieces, not unlike big salt cellars. These pieces may be loaded with sand or shot until they weigh up to a pound. Since they taper toward a point, they must be grasped firmly every time a player makes a move. It's good for hands and wrists and the patient forgets he is curing a disability while interested in the game.

The next step takes the soldier into the gymnasium.



Warm water jet invigorates convalescent veteran and aids blood circulation. Molded device (left) keeps fingers spread as they learn to move and grasp. Below, tying knots and weaving cord helps raise arms, works shoulder muscles and fingers



Here is another department that can be a lot of fun, too. Great, light, air-filled punching bags can be batted back and forth by as many as four men at a time without risk of injury to wounded arms and hands. A wooden rod which can be twisted to raise weights helps the wrists. A device made of a boxing headgear and a padded elastic rope permits the muscles of an injured neck to regain strength by the mere act of bending the head forward against the resistance of the elastic.

There are curved boards on which a veteran can lie, to exercise arms while protecting a spine, perhaps broken in action, but mended now. Other effects encourage arms to raise, knees to bend, legs to walk, abdominal muscles





Adjustable walker on wheels helps many heroes take their first steps. Abdominal muscles are strengthened by sitting-up exercise on slanted board, right.

to toughen. After the gymnasium, the soldier patients move out into the open where they have all of the facilities of college or country club. They go horseback riding, play football, baseball, volleyball, softball, toss horseshoes, enjoy golf or archery.

From the time they are convalescents, the men are encouraged to make body movements which become progressively more active.

On a typical day, a half hour's exercise starts at 10 a.m., either in bed or in the open. During the next hour all ambulatory patients go to the movies. Bed patients do craft work.

At 2 p.m. exercise starts again in beds, outdoor sports fields, gymnasium, metal workshop and arts and crafts workshops. Other patients may be learning to play musical instruments, getting lessons in parlor magic or fishing in the hospital pond.

At four, regulated exercises start again for half an hour. After supper, a theatrical performance is open to walking and wheelchair patients in an auditorium. Individual earphones give bed patients a choice of programs.



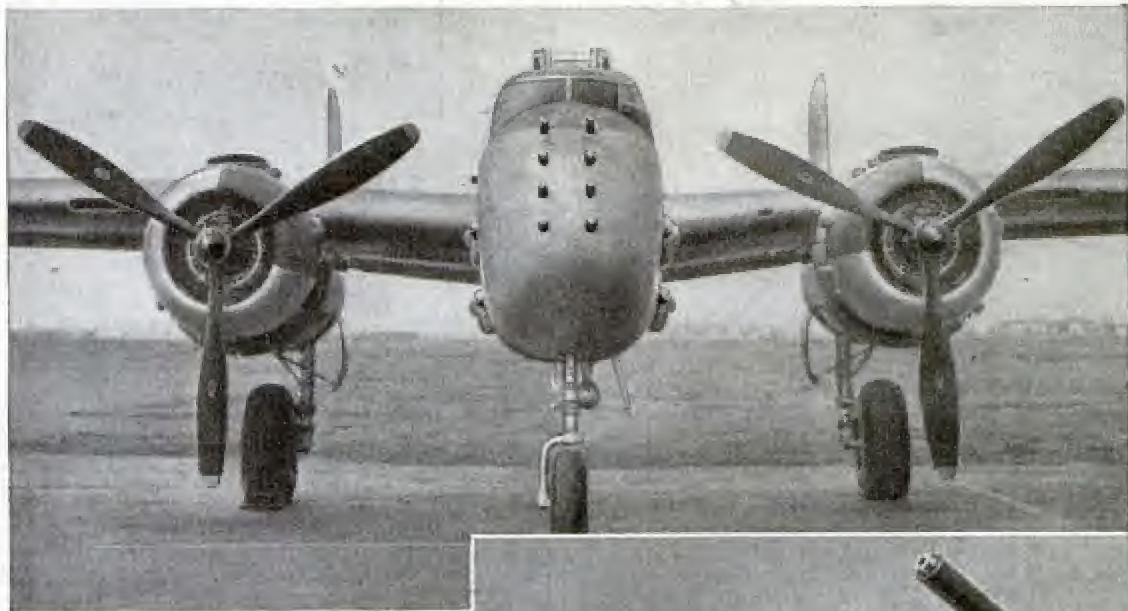
While their muscles and nerves are being reconditioned, their minds are gradually brought around to the fact that they are still soldiers for Uncle Sam, that they are expected to continue their duties to the best of their ability. When the day comes that they are pronounced physically fit again, these lads are mentally ready to carry on the fight.

Mask That Blows Up the Lungs Permits Flying at 50,000 Feet

Air Force crews can fly at 50,000 feet without losing consciousness, thanks to a pressure mask which blows up the lungs as though inflating a balloon. Heretofore the practical limit of flyers breathing pure oxygen was 42,000 feet and then only for brief periods. Today airmen can safely fly a few minutes at 50,000 feet and about a half hour at 45,000 feet.

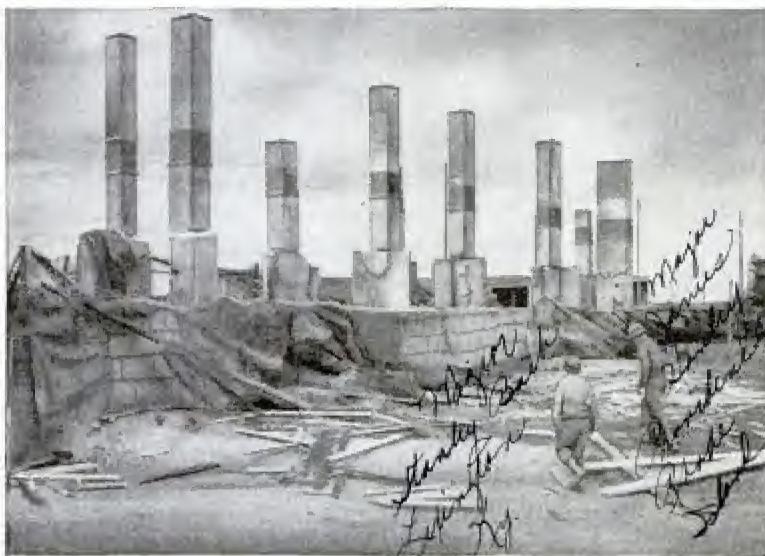
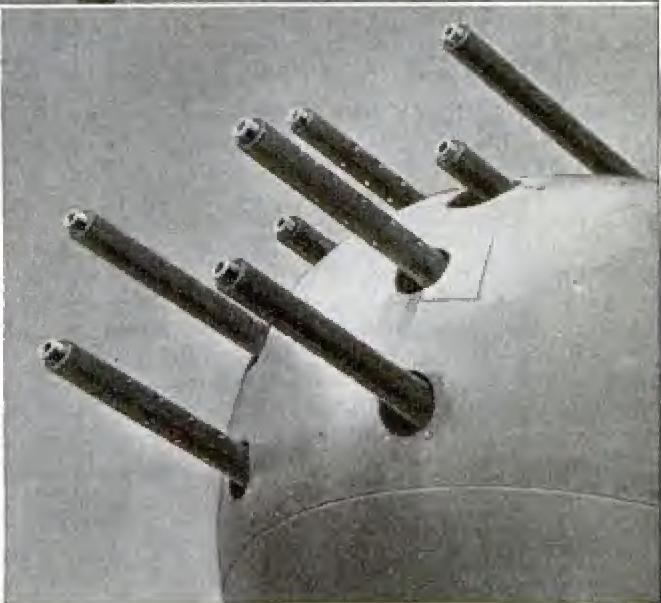
*Sp. Col. A. J. Gogge
POPULAR MECHANICS
Aero Medical Lab.
Wright Field, Dayton, Ohio*

Bomber Packs 18 Machine Guns to Set Record



In rows of four, eight .50-caliber machine guns protrude from the nose of Mitchell B-25 bomber. It has 14 forward-firing .50-caliber guns

When the Japs get their next look at the B-25 bomber it will be a far deadlier plane than the type used in the Doolittle raid. The latest model, with 18 machine guns, is the world's most heavily armed plane. The North American Mitchell medium bomber has 14 forward-firing .50-caliber weapons, including eight in the nose. It also carries two waist guns and two tail guns along with a normal bomb load.



0527 Fake Bomb Ruins Built by Germans To Fool Airmen

Phony "ruins" that resemble a bombed and burned out factory were used by the Nazis in France to conceal underground quarters. The fake bomb wreckage was made of plywood and netting, giving a realistic appearance. It is doubtful, however, if the camouflage would fool the sharp "eyes" of the aerial cameras, especially if the reconnaissance photos were made in color.

The ETHER PATROL

Mr. G. Read, Managing Editor
Radio News, 5050 N. Michigan Ave.
Chicago, Ill.



Hunting clandestine radio transmitter, operator rotates direction finder; calibrated scale indicates bearings of hunted signal. Above at right, huge direction finder has H-shaped antenna to locate signal within one or two degrees. Below, monitoring officer exchanges data over microphone with operator at direction finder



DID YOU ever look for a needle in a haystack? Suppose your life depended upon finding a needle buried in a haystack containing 285,000 pieces of hay. To make the task more difficult, suppose the lost needle were camouflaged to resemble the hay.

Picture this tiny needle as an illegally operated radio transmitter buried under the thousands of signals which are heard as you tune the dial of your receiver. Your job is to pick out a faint signal and bring it in clearly. This will give you some idea of the problems confronting the Radio Intelligence Division (RID) of the Federal Communications Commission in locating clandestine radio transmitters.

The complete usable radio spectrum is about 300 times greater than that covered on the dial of an ordinary radio receiver. This spectrum includes more than 285,000 little spaces where radio signals

may be heard. If those stations were crowded a bit, it would be possible to include almost a million places where signals could get through. This, briefly, is the basic task confronting the "ether patrol."

The majority of personnel of the RID is made up of radio amateur operators. Their background and technical know-how made it possible to handle the maze of necessary technical equipment. The operators are faced with the job of maintaining a continuous patrol of the ether 24 hours a day. Their primary job is to recognize unlicensed



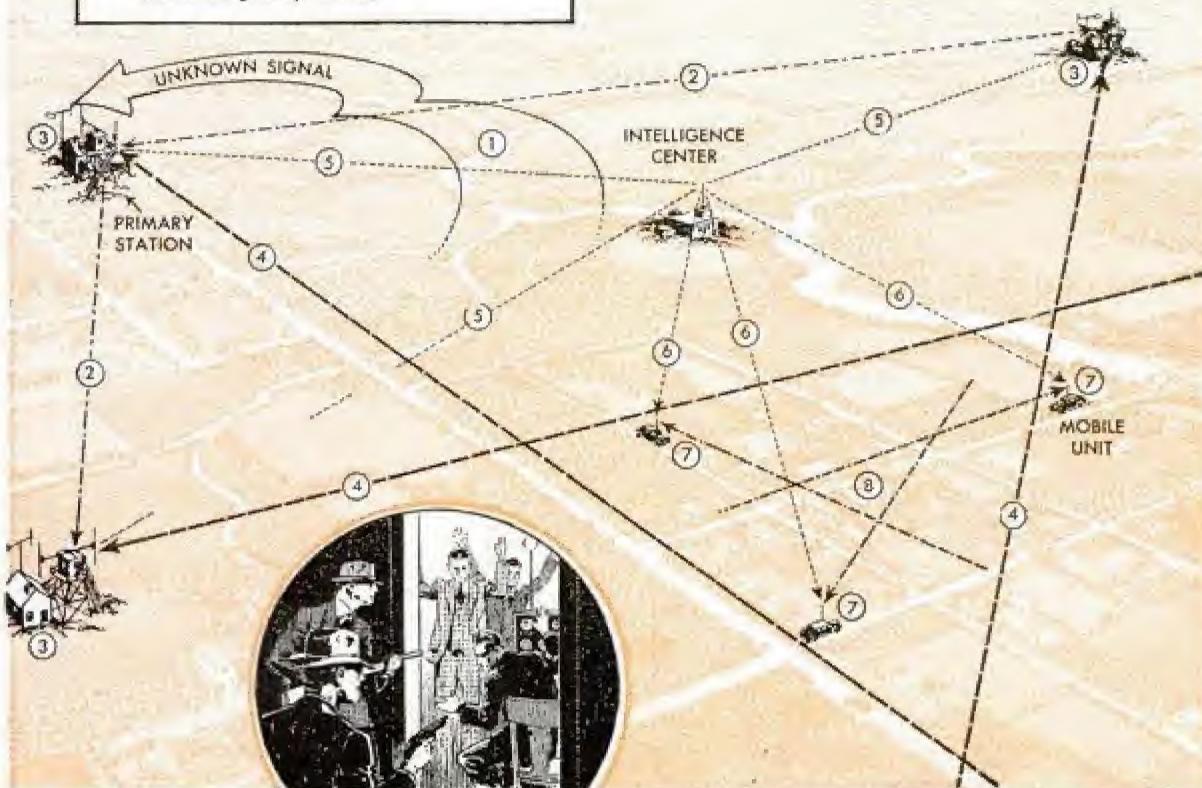
High speed recorder takes code signals at rate of 500 words per minute

1. Unknown signal is heard at one of the primary stations.
2. Other stations are alerted by Teletype.
3. Stations notify direction-finder operators over "Intercom."
4. Long range bearings are taken from several stations.
5. Bearings are sent to Washington Intelligence Center for "fix."
6. Intelligence Center notifies mobile units.
7. Mobile units take short range bearings.
8. RID men proceed on foot, guided directly to source of signal by "sniffer."

transmissions, to locate them and to direct proper authorities to the source.

They must be able to pick out those signals through heavy interference and record vital information so that identification of the station can be made.

When the United States entered the war, the demands for radio intelligence increased a hundredfold. Our government acted at once to prevent information from being sent to our





Taking close range bearing from mobile unit; note wax cylinder recorder. Right, terminus at primary station for the feeders from eight antennas

enemies. Cable service and radio telephone were stopped and the only way secret intelligence could be sent to foreign shores was by clandestine radio.

Through the efforts of the RID nearly 400 unlicensed transmitters have been located in the United States, its territories and possessions since July 1, 1940. In addition, over 9,000 cases of alleged unlicensed and subversive transmissions in this country and elsewhere have been investigated. About one-third of these were reports of subversive activities. More than 200 Axis spies have been rounded up in South America with the help of the RID operating within the United States. Thanks to the

efficiency and alertness of the RID, such clandestine stations are, in this country at least, practically nonexistent. The RID, probably the least-known government agency, is headed by George Sterling, W3DF, prominent radio engineer. The RID was set up originally to combat illegally operated radio stations used to facilitate rum running and to give out race track information. It has since expanded into one of the most important nonmilitary wartime agencies.

Scattered throughout the United States, its territories and possessions are 12 primary and 32 secondary monitoring stations. In addition,



there are more than 50 radio-equipped mobile units which operate in conjunction with the various primary stations. The sites for primary stations are chosen for excellence of reception and are scattered advantageously in order to take bearings with a high degree of accuracy. The activities of these stations are directed from three radio intelligence centers located in Washington, D. C., San Leandro, Calif., and Honolulu. The secondary stations are much smaller than the primaries and their equipment is not nearly as elaborate.

One of the most important pieces of

Adjusting flexible disc to record unknown signals; new techniques give hour's recording on each side

Divers Wield Air-Driven Tools To Salvage Sunken Ships

equipment found at primary stations is the Adcock direction finder used for "long range" bearings. This peculiar-looking antenna resembles the letter H. It operates in much the same manner as a portable radio set with a built-in loop aerial. The public is familiar with the fact that by turning a portable set it is possible to discriminate between certain stations. Mobile units use a compact loop antenna for taking "short range" bearings.

The Adcock direction finder consists of vertical antenna elements and a transmission line which terminates to a Hallicrafters SX-28 communications type receiver. It is capable of determining the direction of a signal within one or two degrees. When directions from several different points are known, it is possible to establish a "fix" on a map by projecting the lines (in degrees) with respect to true north.

Let us follow a typical routine as witnessed at the primary station near Allegan, Mich. Operators are familiar with transmissions from every licensed station in the world. They know their peculiarities and even the style of the announcers. Their job is to listen continuously to signals as they tune their receivers back and forth throughout the entire radio spectrum. When a signal is heard which is not familiar to them they carefully analyze the transmission and make pertinent notes which will later serve to identify the signal. The frequency, or wave length, of the station is read directly from the receivers which have their dials calibrated. This information is immediately sent by teletype to other stations of the RID network. All stations tune to the wave length given in order to monitor the same transmission.

The operators on duty at the Adcock direction finders far out in open areas are notified over the "intercom" system, a permanent part of the installation. These operators also tune to the wave length given and exchange confirmatory data with the operators in the Cruising Room.

By means of special directional receiving antennas, it is possible to advise an operator at a direction finder as to the general direction from which the signal is emanating. This saves considerable time in establishing a bearing.

By co-ordinating the bearings taken by various primary stations, the intelligence center is able to determine the general location of the transmitter.

Mobile units near the established area are then sent to the scene in order to take short-range bearings. Operators in the mobile units are able to communicate with other units by means of two-way radio. By exchanging information they are able to

(Continued to page 158)



Lessons learned in salvaging ships sunk at Pearl Harbor and in lifting the U.S.S. Lafayette (formerly the Normandie) are expected to give divers a better chance of recovering the billions of dollars in cargo treasure sent to the bottom of the sea during the war. One example of progress made in salvaging methods will be wider use of compressed air and air-operated tools. Pneumatic tools ordinarily used only on the ground now are taken deep down in the water. Paving breakers are employed to shatter bottom formations of certain types or for freeing materials inside a flooded ship. When a ship is caught on a reef, rock drills are used to put holes in the rock so that the obstruction can be blasted away from the ship. Air-driven impact wrenches are used in backing off nuts on bolts holding gun mounts or machinery foundations so that such equipment may be reclaimed. Before the war, use of pneumatic tools in other than shallow water was complicated by the practice of leading the tool's exhaust to the surface through a connecting hose to avoid back pressure of the water against the exhaust, which causes unsatisfactory operation. At Pearl Harbor divers simply increased the air pressure at the surface to exceed the hydrostatic pressure. The same compressors which drive the tools can supply air pressure to force water out of compartments, power air lifts and operate pumps.

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1 Park Ave.
N. Y., N. Y.

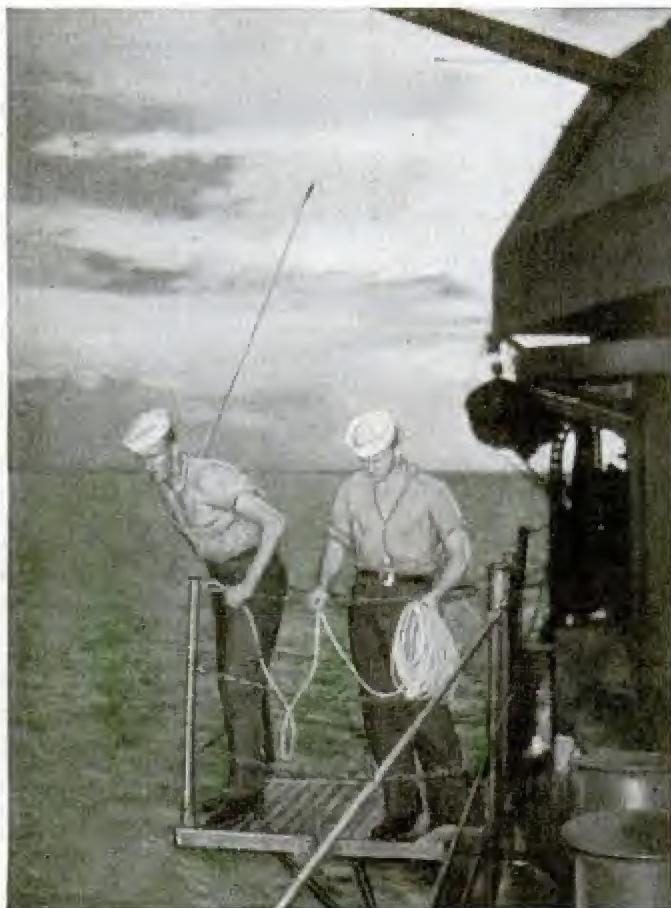
O-334



U. S. Navy photos

Selection of this gun crew firing salvo broadside began back at recruiting station. Below, specialists check depth of water

FITTING the GOB to the JOB



WITH an ear-shattering crash of her main batteries, one of Uncle Sam's new light cruisers reaches the climax of her shakedown cruise. The terrific shock of her own gunfire tortures the vessel's structure.

A checkup of the ship's guns and instruments follows. Suggestions are offered for repairs and possible improvements when the vessel returns to port. No man can predict exactly what a warship will do until it has been tested at sea.

But with the crew of this new light cruiser it is different. The hundreds of men aboard are as far advanced toward becoming an efficient fighting unit within one week as eight months of sea duty would have made them a few years ago.

That's what scientific testing, intensive training and card-indexing of aptitudes have done for the personnel of our expanded navy. For the first time in history, new warship crews are virtually "prefabricated" by modern methods of fitting the gob to the job.

For example, take the captain of one of the gun crews on this new cruiser. This lad's record is on file in the executive officer's



offices aboard. The record might show that he was quarterback on his high school football team. That indicates a quick mind, sharp eyes and calm nerves.

The gunner alongside him is holding his post in part because darkroom tests made with flashes of light show his eyes recover quickly from the effects of a brilliant flare. This is especially important during night fighting when the flash of a gun blinds some men for minutes.

Another man in a gun crew was chosen not only because he is husky and agile, but left-handed. This makes him more dextrous in feeding shells from the position he must occupy during action, and helps in managing the controls.

Still another man is in the gun crew because his eyes are not only

Curtiss scout leaves catapult in burst of speed for routine observation. Below, gun crew captain must have a quick mind





Pre-trained crew awaits "battle" test on shakedown trip aboard cruiser

perfect, but spaced wide apart, a prerequisite for operating a certain wide gunsight.

The records of the gun crews show that almost every man played baseball, football,

plumbers ashore, an upholsterer might be working with rope or canvas. Best of all, a cook was probably a cook in civilian life, a butcher was a butcher, a photographer a

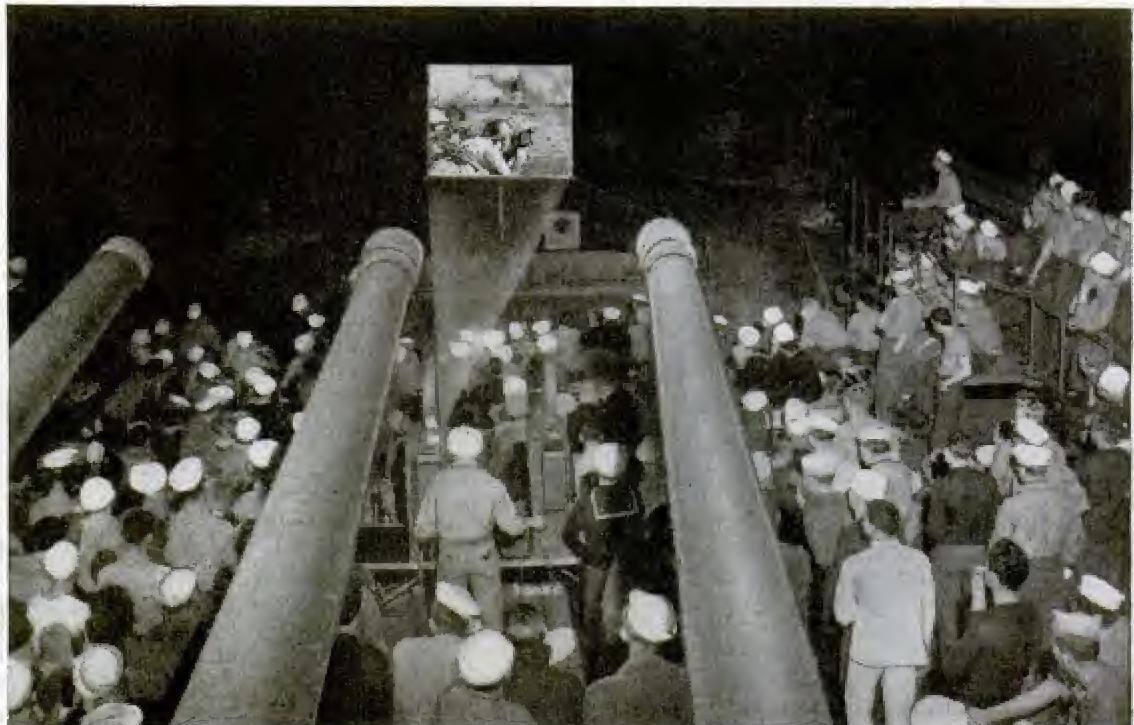
basketball or some other fast sport requiring team play. A gun crew is a team and if a man played checkers or chess for a hobby, or picked flowers in the woods, he probably would not be the type for a gun crew.

However, the best team-spirited athlete would not be likely to find himself in a turret gun crew if he were five feet nine inches tall. The reason? Not enough headroom in a turret.

A musician becomes a radio man on this new cruiser because his ears are trained for sounds. A "battle talker" or any man stationed on the telephone answered the personnel interviewer's questions in a clear concise voice. Thus he passed an aptitude test without knowing it.

Certainly some of the shipfitters on this cruiser were likely to have been

Shakedown crew views training film on open deck after day of battle problems simulating the real thing



cameraman or camera fan, and even the ship's soda jerker might have done the same thing on Main Street.

The night lookout is a chap with extraordinary night vision. Here is where extensive aptitude tests in dark rooms, and others with red goggles are followed by intensive training. Even with good night vision, a night lookout must learn the tricks of the trade. For example, when the slightest object appears at night he is shown how to shake his head from side to side instead of looking directly at the barely discernable thing because the eyes function better in this manner.

Even after a lookout has passed eye tests he gets lengthy drilling in such facts as these: at the water's edge, the horizon is 2.8 miles distant; on a mast



Signalman (left) needs nimble fingers; "talker" (right) a clear voice



Gun crew gets sighting practice on bomber. Right, net for shell cases under turret protects deck



115 feet high it's 12.3 miles away, and so on. Time was when a man learned this aboard ships but not today.

Practically every man aboard this new cruiser received special training before he ever saw the craft. In fact, some officers, especially in the enginerooms, were assigned to the ship before the keel was laid and they saw every stage of the ship's construction.

The program of scientific selection of navy crews got under way when officers faced the fact that more





Paravane (mine clearing) gear is readied for drill. Below, bell is rung in daytime



than 2,000,000 men would be placed in navy jobs. In the leisurely past, a gob was given the four years as a jack-of-all-trades to find out what he was fitted for. If he re-enlisted, something was done to shape him for his future. This was too slow for the tempo of modern war, so the system of putting the right man in his right billet begins with interviews for recruits in induction centers. These help decide where they are likely to land in the gigantic naval program.

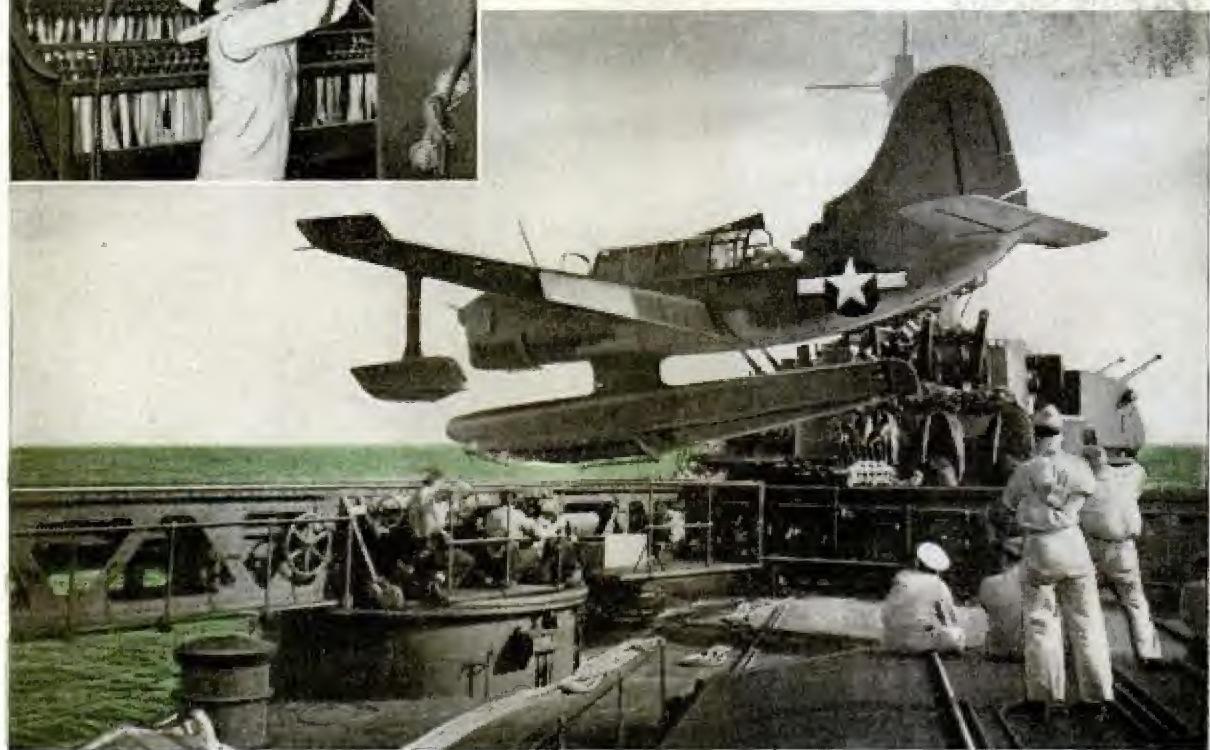
A pool arrangement was set up in Miami for

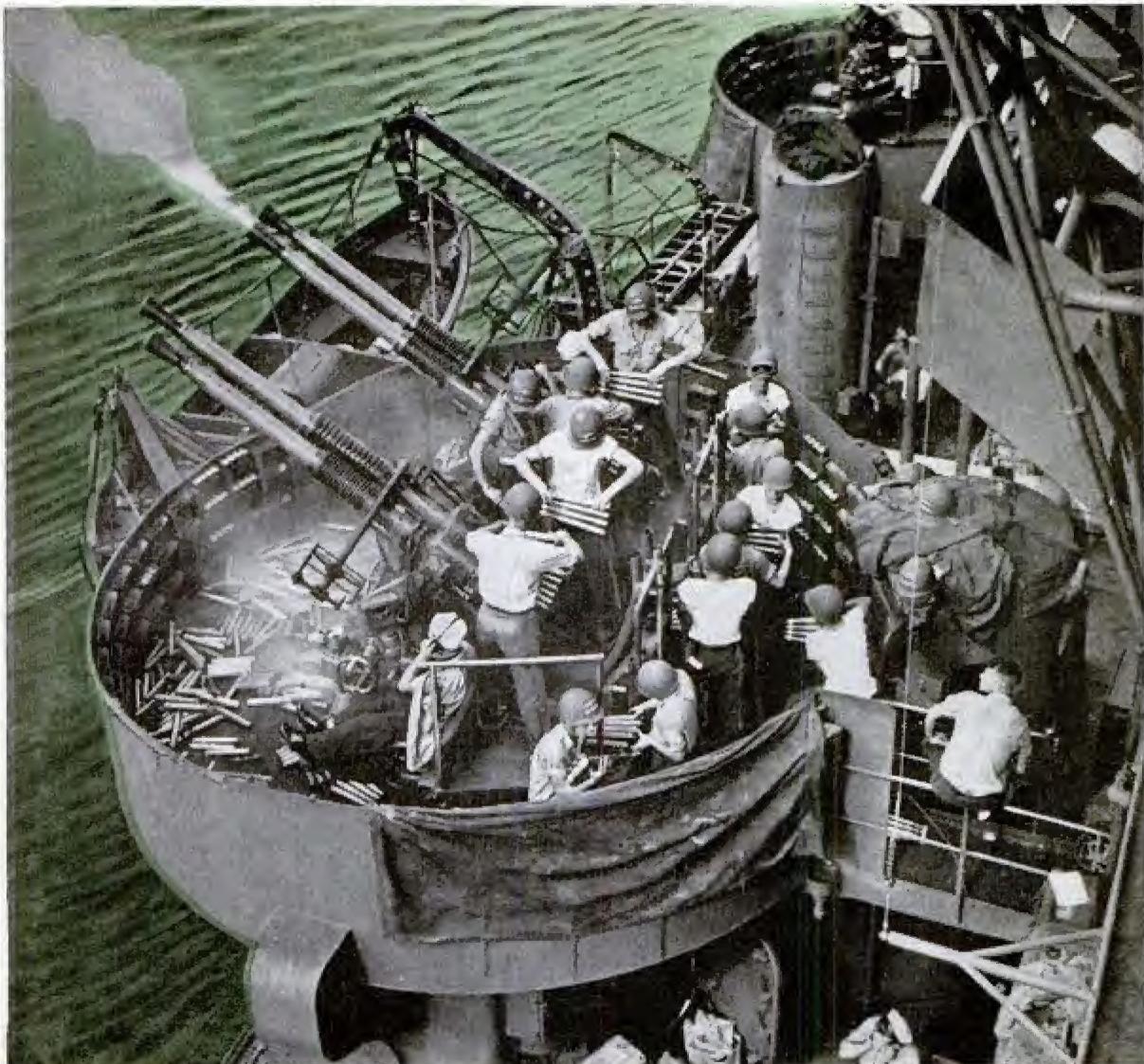
training nucleus crews, one of which was intended for our new light cruiser. The balance of the men for her crew were trained at such points as Norfolk, Va., while the new cruiser was being built. Mechanical rates from the Miami crew assigned to the cruiser were sent to the shipyard in some cases to observe the construction.

Finally, executive officers picked most of the balance of the crew from the Norfolk pool and put them into team training. Many of the future crew were trained on the cruiser while she was getting final fitting.

Now comes the great day—the day when the new cruiser shoves off. The men have been fitted

Below, launching seaplane from catapult is specialists' job





to their jobs. Now they will be fitted in their jobs. A siren blows. The propellers move.

There is a sounding of general quarters before the ship is hardly under way. Time was when this brought about indescribable pandemonium. But these men, with a minimum of confusion, scurry to their stations where they remain several hours. Division officers instruct each man once more in his duties and then in the duties of his nearby shipmates, for one must take over during battle if another is killed or wounded.

They must know the ship so thoroughly that they can find their battle stations in darkness—or the next thing to it, the feeble gleam of battle lights. They must learn every possible avenue of travel about their own parts of the ship for an enemy

Here's where teamwork counts, and every man is trained to carry on work of wounded mates. Below, even soda jerkers on new warships receive special training to man battle stations





Navy cameramen (many were photographers in civilian life) catch fire ring and fire ball from 5-inch guns

shell may close a passageway or flood several compartments.

From then on, they learn that a shake-down is no joyride. Three or four general quarters are sounded every day. Watches are posted. Additional duties are assigned. The cruiser sets a zig-zag course which keeps the navigator so busy he is away from his post only for short intervals, grabbing sleep in snatches.

Firing tests begin. Damage control par-

ties follow up with inspection of every compartment. Battle problems start. A zero hour is set. The public address system begins to chant the time periods remaining before the "battle" starts. Men are handed slips of paper containing the problem.

They are notified of hypothetical shell and torpedo hits and casualties. Remedial action must be taken quickly. Answers to the problems come: "Bulkheads shored up . . . submersible pumps started . . . counter-flooding commenced . . . manual control of communications, powder and shell-handling devices begun."

An imaginary attack comes from a group of torpedo planes and dive bombers from 40 degrees, flying at 20,000 feet. The antiaircraft guns begin throwing up a curtain of flak.

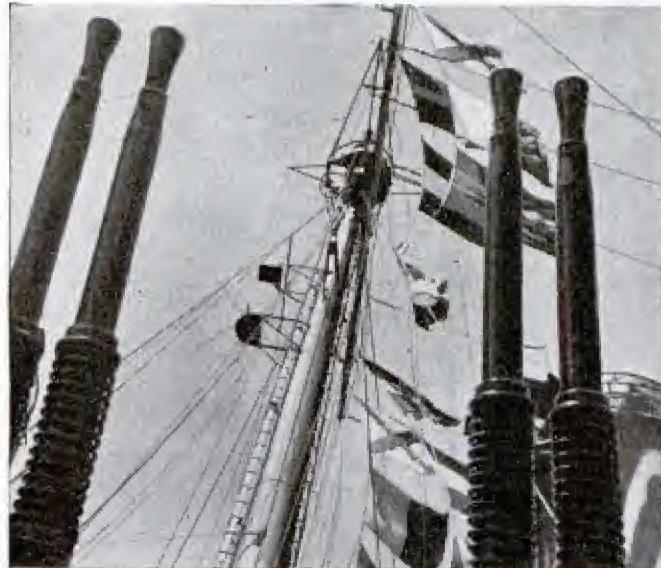
A torpedo wake is discovered. The skipper orders "left full rudder." Another imaginary torpedo crashes into the port quarter below the water line. The damage control officer estimates injury to



Racks on splinter shield of gun keep ammunition within reach

the ship. Hypothetical fires are extinguished. Repairs are ordered for damaged electrical systems. Perhaps the torpedo hit would cause a dangerous list. The answer is that compartments on the starboard side must be filled with water—and quickly.

Tugs and destroyers tow targets for firing practice. Planes tow sleeve targets. A five-inch gun will send a star shell aloft and the ack-ack gunners will tag the tiny parachute before it has a chance to get wet.



Signal flags are framed between Bofors guns. At right, "B-Day"—for airing bedding

Below decks, the engineroom crew begins the less spectacular but just as vital job of testing the cruiser's speed in a full-power run. Because new machinery cannot stand the tremendous temperatures and strains of too sudden application of full power, speed is gradually stepped up for four hours. For the next four hours they give the engines the real workout. Then for the next four the speed tapers off. At

Like the gobs, trained Navy air pilots are at home as soon as they come aboard

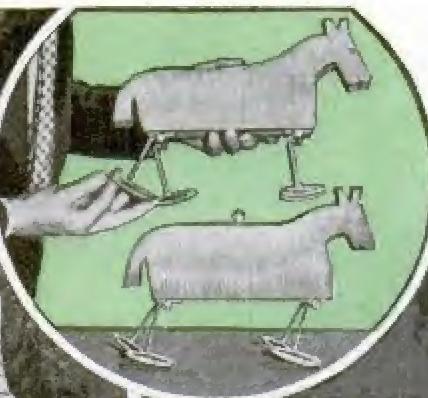
the end of this twelve hours, the engineroom crew can relax.

After weeks of this kind of activity, interspersed with jobs such as painting, washing decks, airing bedding, washing, and the hundreds of miscellaneous tasks common in a modern warship, the crew heads the ship for home—and the "final examination." This time the battle problem is a corker and no one aboard knows what it will be.

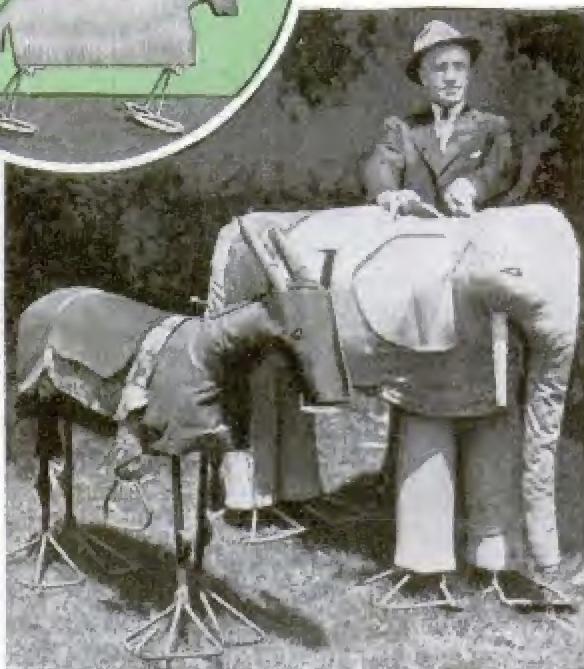
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Riders Shift Weight to Walk Mechanical Steeds



Extreme left, riding an "elephant." Left, toy models show principle by which these animals are made to walk. Below, note wide feet of "mule" and "elephant" to avoid tipping over



Mechanical animals which can be ridden at several miles per hour and guided in any direction have been patented by a California inventor. Locomotion is accomplished merely by shifting the rider's weight from side to side, rocking the apparatus so that the steed's right legs and the left legs are released alternately from the ground. Each leg is attached to the body by an offset hinge, which allows the leg to swing forward by gravity when pressure is released. A wide base under each leg prevents the animal from tipping over. Steering is accom-

plished by a handlebar between the animal's shoulders connected to both front feet. The walking animals will be placed on the market after the war.

B-24 Rides a "Merry-Go-Round" to Check Compasses

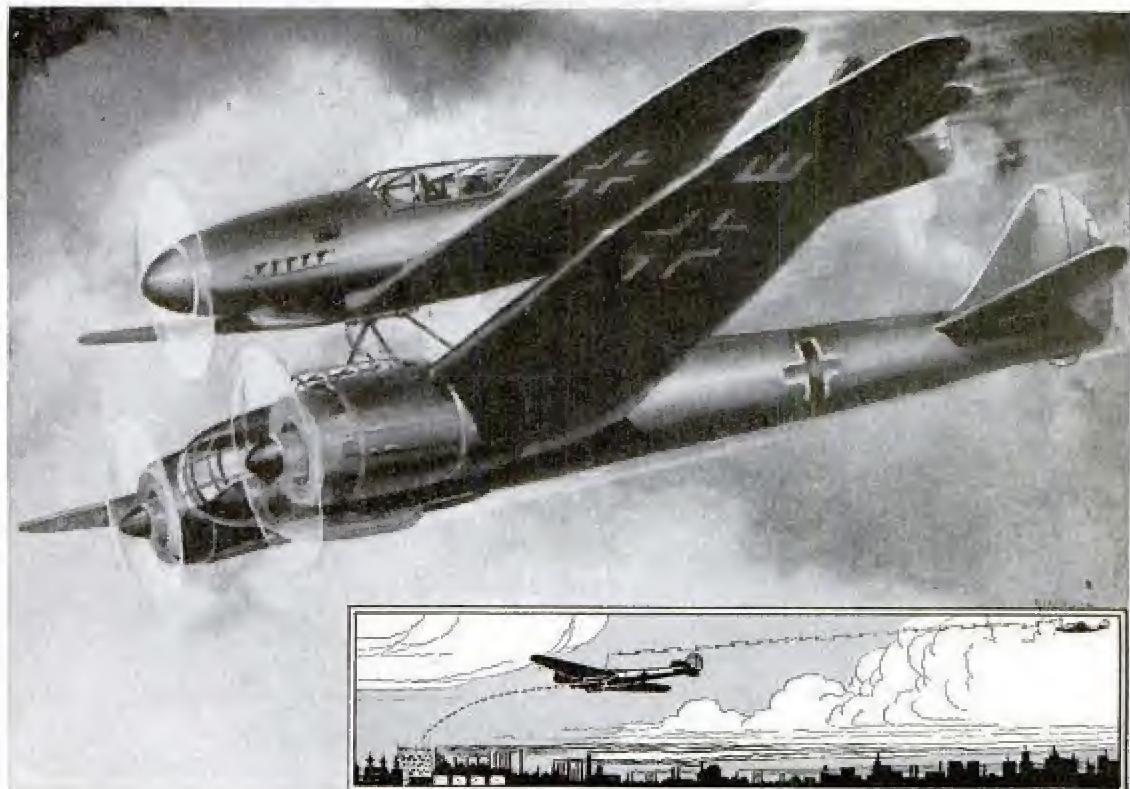
Before Liberator bombers leave the Ford Willow Run plant, they get a ride on a large wood turntable, a mechanized compass rose. While a bomber is rotated through 360 degrees, the three types of compasses

on the B-24 are checked. The turntable compass rose is believed to be the only one of its kind. Also at this station, the gun turrets and waist guns are fired with live ammunition on even numbered ships.



'Pickaback Plane' Releases Junkers Full of TNT

0448



As the robot bomb-launching sites in France were captured, the Luftwaffe tried using obsolete, crewless Junkers 88's packed with TNT as glide bombs. An Me-109 was attached pickaback to the Junkers, which was stripped of its guns and other equipment and loaded with from two to four tons of explosives. Special attachments permitted all three engines to be utilized. The plan was to have the fighter

pilot fly the super "doodle-bug" to enemy territory and cut the pilotless craft loose, aiming it at some specific target. Allied flyers reported the strange contraption was a "sitting duck" target in the air, while ack-ack crews said it was almost as easy to hit it from the ground. Its speed was estimated at 150 miles per hour—less than half that of the V-1 flying bomb and its accuracy was judged to be no better.

Twin Rotors Propel Helicopter Designed by 19-Year-Old

Two overhead rotary blades instead of one lift a helicopter designed and built by a 19-year-old San Francisco inventor. The machine, which has no tail rotor, took off

and landed successfully half a dozen times in a recent test. The two superimposed rotors, which turn in opposite directions, are 25 feet long; overall length of the fuselage is 12 feet. It is powered by a 90-horsepower engine. Stanley Hiller, Jr., the inventor, has named it a "Hiller-copter." The youthful "Sikorsky" of the West Coast reports that he began work on the ship when he was 16.

277 Second Ad.
Berkeley, Calif.

A smooth white cream developed by a California company forms an invisible "glove" to keep grease, paint and dirt from getting into the pores.

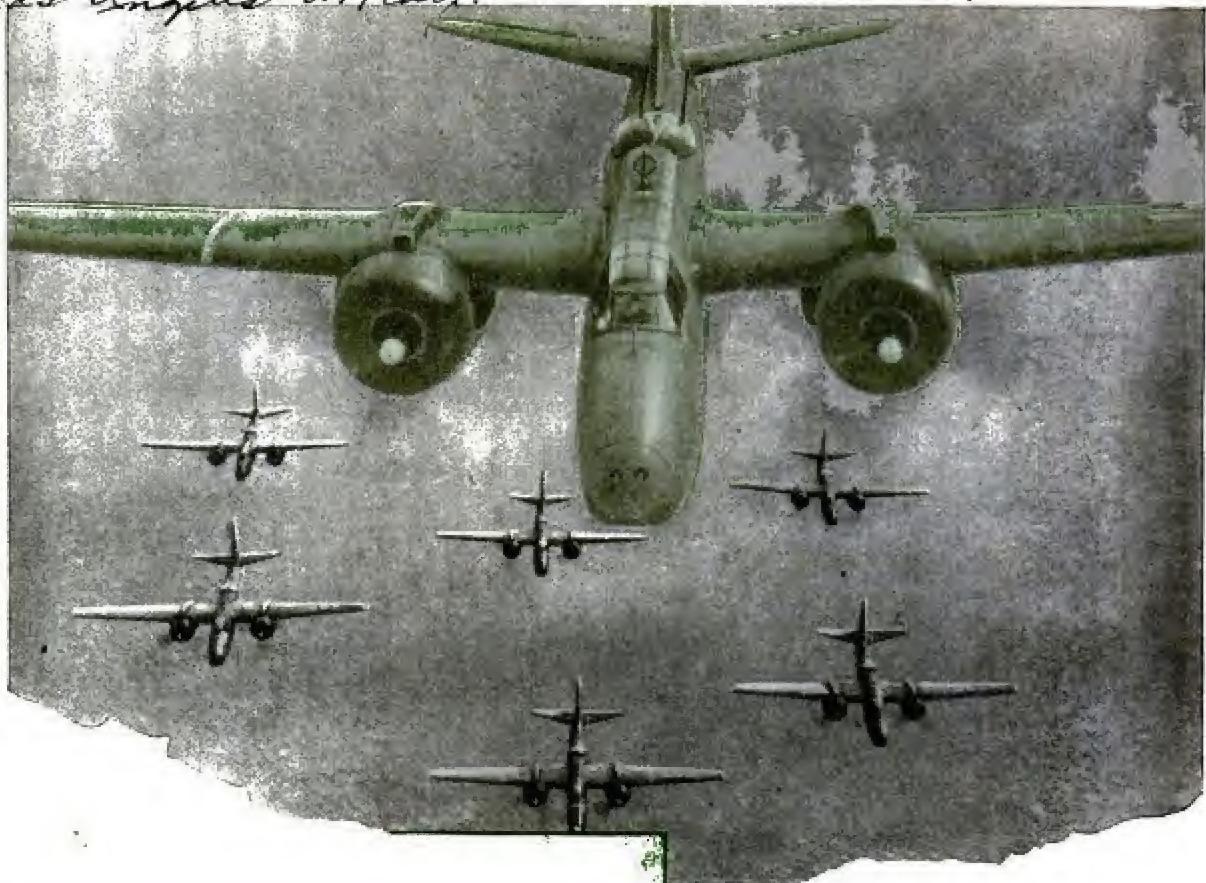
NOVEMBER 1944

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0417



Douglas A-20 planes with gunnery noses; other A-20's have bombardier in the nose

TWENTY-FIVE tons of airplane had gone berserk in the sky. A minute ago the big four-engined "Skymaster" had been cruising smoothly at 250 miles per hour, then suddenly its whole structure began to buck and vibrate as if a giant hand was trying to shake it to pieces.

Ninety feet aft of the cockpit the huge rudder was slamming back and forth, out of control. The fuselage quivered, the wings were shuddering, and Bert Foulds and his co-pilot in the cockpit felt as if they were experiencing an aerial earthquake.

Foulds eased back on the throttles and both pilots braced their feet against the rudder pedals. That helped to stop the wild jouncing but the plane still had the shakes.

By now the two test pilots had a good idea of what was causing the trouble and they came down

One of the Douglas test pilots climbs into an A-20 "Havoc" for its No. 1 flight

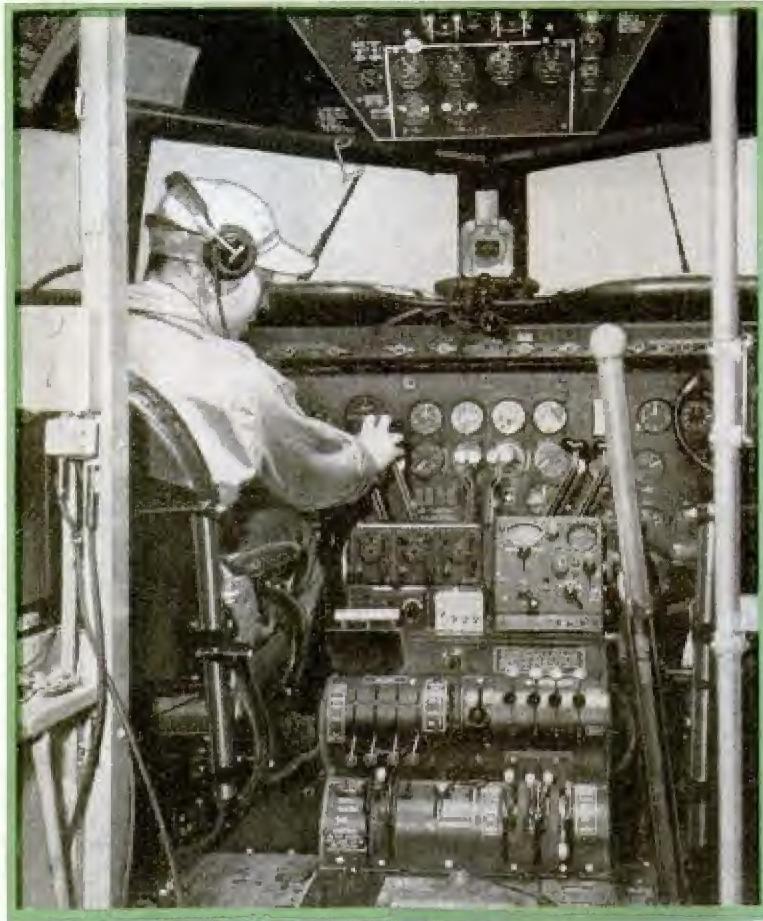


Above, A-20 attack bomber lands after initial test flight. Left, test pilot makes preparations to go aloft. Below, ground inspector checks a rudder trim tab on a new plane

for a cautious landing. They found, as they expected, that the mechanism that controls the rudder trim tab had been mounted improperly. The device had worked loose, permitting the small control tab to flop the rudder itself back and forth. The rudder in turn was shaking the entire plane.

Foulds hadn't known that the airplane was going on a rampage when he took it up, but he had expected trouble of some kind. He and the 135 other pilots of the production flight testing department of Douglas Aircraft Company are professional trouble hunters. Few aircraft are perfect when they come off the assembly lines and the job of the production test pilots is to take these planes up on their first flights, hunting for irregularities so that each malfunc-





Test pilot checks instruments and controls of a C-54 Douglas Skymaster before taking it up in the air to hunt for possible kinks during flight

tion can be corrected before the plane is delivered.

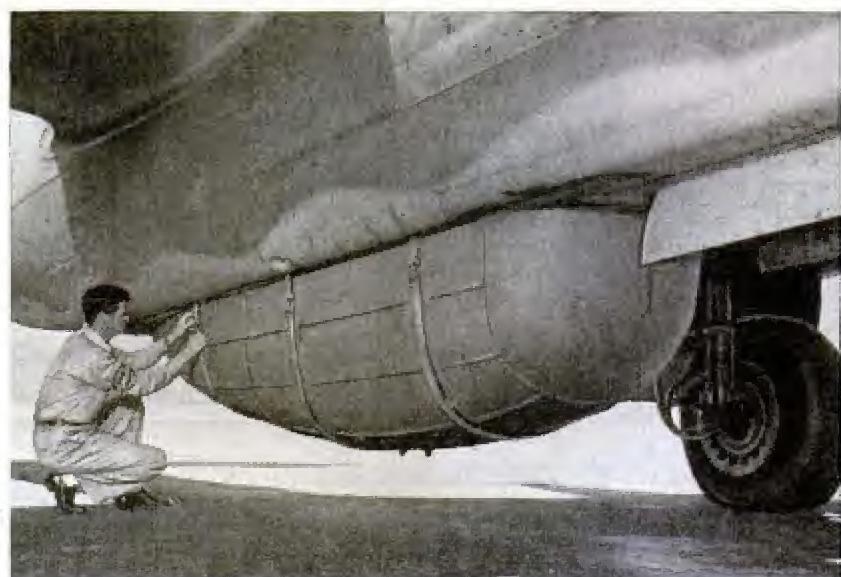
Crack pilots such as Douglas "Wrong Way" Corrigan who flew to Ireland "by mistake" some years ago, Frank Fuller who won a Bendix air race, and scores of other ex-headline-makers are in the organization, headed by **Jake Moxness**. Each has some 3,000 hours in his log book and each is expert at diagnosing faults in the air. The group makes 40,000 flights per year from the six Douglas plants and they fly some eight million miles every 12 months. There have been no fatalities since the war

Inspector examines the auxiliary fuel tank fitted below the bomb bay

began, though pilots have landed with some or all engines dead, have slid in on the nose when the nose wheel jammed in its doors, and have brought planes down on fire.

That last occurrence can't happen again. In case of fire, each pilot has strict orders to abandon his plane over unpopulated territory and to come down by chute if he can't quench the flames. His life is more valuable than the plane. Before this rule went into effect one pilot successfully landed a flaming plane and then almost lost his life in getting away from it on the ground. The pilot was climbing out on the wing when his parachute straps caught. In the meantime a broken fuel line was pouring flaming gasoline on the ground below him. He fell part way, then hoisted himself up again. By that time his legs were badly burned. He crawled to the opposite wing tip and jumped 12 feet to the ground.

The record of no fatalities and few accidents in the Douglas test organization is due to the development of standard procedures to combat any emergency. A fire during flight is very rare, but occasionally on a first flight it happens that a plane's fire



alarm system goes haywire. The red warning light flashes on in the cockpit, indicating fire at a certain engine. The pilot can't be certain that fire actually has broken out but he takes no chances. He feathers that engine's propeller, cuts the ignition switch, and pulls the toggle that releases carbon dioxide gas in that engine nacelle. He continues to cruise until he is satisfied that the fire, if any, has been extinguished. Then he lands.

Any imperfections in construction or operation can usually be found during a plane's first flight. Most of the malfunctions are of a minor nature: "Air speed indicator registers 40 m.p.h. at wide



Above, looking for flaws in hydraulic brakeline installations. Left, the slenderness of an A-20 cockpit as seen from above



open throttle," "Plastic windshield panel distorts in flight," "Command radio not receiving on all frequencies." These are typical of the reports pilots bring back.

More serious are occasional hydraulic system failures. A pilot may be unable to extend his wheels into landing position and he may be without brakes if a hydraulic line gives way. When that happens he goes over to emergency procedure. From the cockpit he can disengage the landing gear from the retracted position. This al-

(Continued to page 160)

**Fire-fighting equipment
is kept handy as engine
roars for the first time**



Gun-Lamp Protects Flyers From Enemy in Sun



Manufactured by W.H. O. Long Dist., Bound Brook, N.J.

Every airman's bugaboo—attack by enemy planes diving out of the sun—has been eliminated for army and navy flyers with the installation of a brighter gunsight lamp of unique design. Using the old-type gunsight, gunners could aim within only 15 degrees of the sun, thus leaving a dreaded blind spot; with the new lamp, the sight lines or "reticle" will be visible to the flyer even against the sun's strongest glare, and gunners can aim directly into the sun with great accuracy. It no longer is necessary to use a dark filter which tends to obscure the target. The new lamp, which is about the size of a walnut, provides light from 8 to 30 times brighter than the old gunsight lamp but with the same filament wattage. Nor must the gunner "glue" his eye to an eyepiece in order to draw a deadly bead on his target. His head can move an inch or two without impairing his aim.

0326

Funnel Helps in Filling Cartons For Quick-Freezing Foods



To simplify the packaging of foods by housewives, a wire frame and funnel are used together as a carton-filler. The frame is put into a Cellophane bag to keep it taut and unwrinkled, preventing tearing, and the bag, which is long enough to permit overlap-

ping and seal out moisture, is inserted into the carton, where it remains upright. The wire frame supports a wide-mouth funnel which prevents spilling the food when pouring it into the carton.

0291

Sound Waves Find Metal Flaws By Timing of "Echoes"

With a machine that shoots out sound waves and records their movements, hidden flaws in metal castings are quickly located. When a sound wave strikes a flaw in the metal, it bounces back like an echo to the machine. The time that it takes the wave to get back to the machine is recorded, and from this the exact location of the flaw is determined. For example, a sound wave striking a flaw one inch from the point of entry will reflect back in eight millionths of a second. The machine, called a supersonic reflector, was invented and patented by Dr. Floyd A. Firestone, University of Michigan physicist. It will examine a piece of steel five or ten feet long in one second, which is much faster than the X-ray test now used on metals.

Ann Arbor, Mich.

Save Paper to Make Bazookas

0530



How many bazooka barrels do you have in your attic or basement? They may be in the form of old magazines and newspapers or just waste paper, but to a hungry war industry they are the makings for the plastic barrels of flying bazookas used on Thunderbolts and other fighters. The lightweight bazooka barrels are made of a special paper plastic developed by the General Electric Co. The Scout (above) is doing his bit by delivering waste paper to make rocket launchers.

MECCA for MILLIONS

O 397

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Mr. Alex Warren C. Math, 1 Park Ave., N.Y., 19, N.Y.

Above, upper concourse of New York City's Grand Central Terminal, sometimes used by 230,000 train passengers in a single day. Below, chief operator's tower, which controls all the movements of trains

ABOUT 260,000,000 pairs of feet took billions of steps in one of the most famous buildings in the world during the past year, yet few caught more than a hasty, passing glimpse of the remarkable structure which is busier than many cities.

The structure is Grand Central Terminal in New York City. The millions were hustling New York office workers and wartime travelers, part of the greatest flow of railroad traffic in history.

In a recent day more than 230,000 train passengers entered and left Grand Central Terminal. At least 600,000 other people, non-passengers, hurried through the Terminal's concourses and subterranean passages in the course of their business day.

Few of the millions who an-

NOVEMBER, 1944



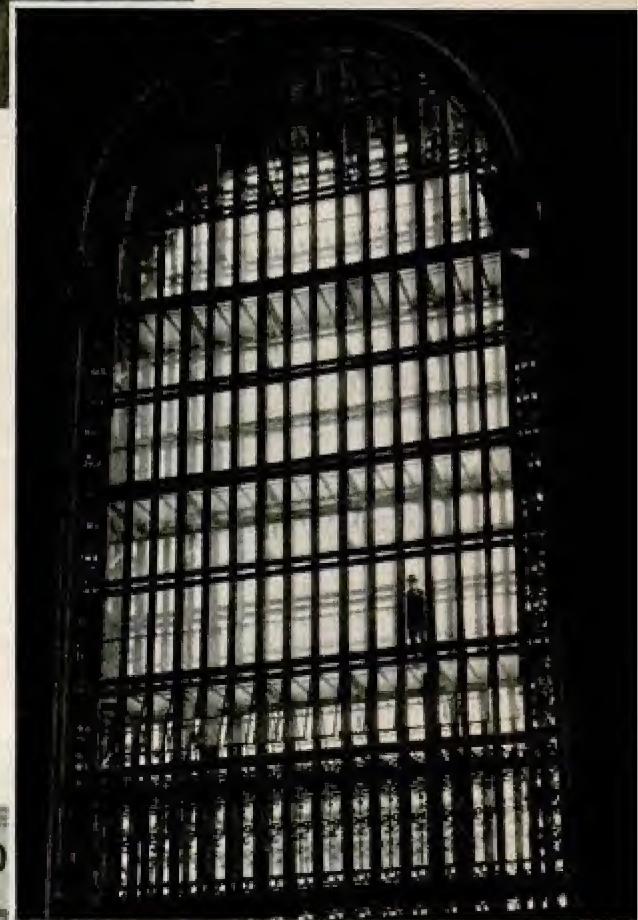


Sorting sailors' duffle bags (above) in the Terminal. Right, one of the Terminal's many gigantic windows

nually go through Grand Central Terminal see all of it because the building was designed to keep 30,000 people at a time moving to and from trains. The trains themselves, during rush hours, glide in or out at the rate of one every minute on its 67 stub tracks, a two-layer network of steel occupying some 48 acres of the most valuable real estate in the world.

Wide ramps hurry passengers to and from a concourse 272 feet long, 120 feet wide and 125 feet high. Here are ticket sellers, travel bureaus and information dispensers. Here are some of the largest windows in existence. Here is one of the biggest flags ever made, five stories tall. Most travelers see this much before other ramps, which again encourage speed, prevent accidents, help invalids and facilitate baggage handling, send passengers on their ways.

Grand Central Terminal is a city in itself



so complete that a fortune-seeking youth could arrive there and by using underground footpassages grow to old age without ever setting foot on the sidewalks of New York. Only when it came his time to die would it become necessary for him to travel on a New York street, for there is no undertaking parlor in the Grand Central Terminal.

Subways connect underground with scores of huge buildings and stores but the terminal and its subterranean passages alone enable a pedestrian to walk five blocks north and south underground. Without using streets, the visitor is able to enter and leave three hotels, the Commodore, the Roosevelt, and the Biltmore,

Left, typical wartime lines waiting to try for train reservations

and one club—the Yale. Passages connect with nine skyscrapers, one the 35-story office building owned by the New York Central System, which operates Grand Central Terminal. This structure, together with the terminal, rests on stilts of steel, since the supports are pillars between the underground tracks where trains of the company and of the New Haven Railroad enter and leave.

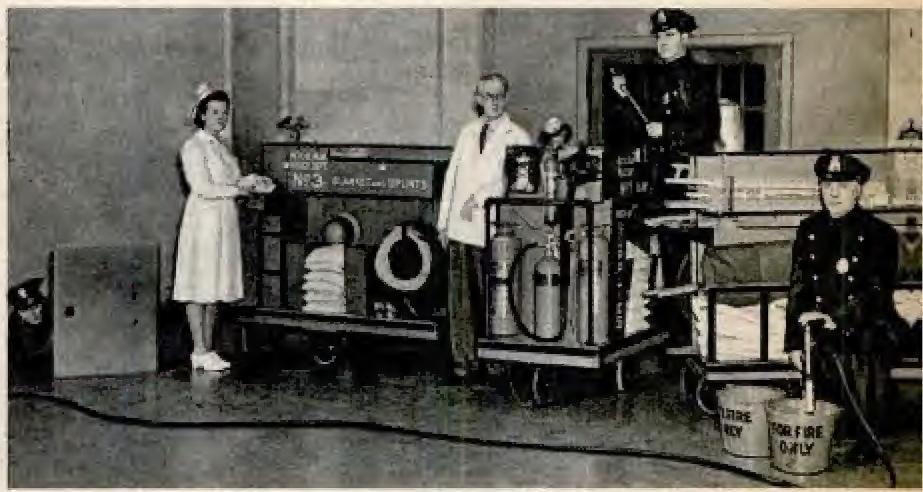
Subterranean and skyscraper life in "Grand Central City" embraces hotels to eat and sleep in, office buildings in which to work, seven restaurants, eight soda luncheonettes and two milk bars. The scores of shops include five book stores. Five banks are in the environs, as well as a movie theater, six bootblack stands, a liquor store, two barber shops, three parcel-checking rooms, six cigar stands, 22 newsstands, two drug stores, a printing shop, haberdasher, hairdresser, jeweler, cutlery store, candy store, bakery, art gallery and television studios. The 231 telephone booths are inadequate in wartime.

At a single terminal oyster bar, 15,000 oysters and 11,000 clams may be served in a day.

Seldom does a visitor get a chance to explore the railroad yard beneath the 722-foot roof of the main station building and the cavern of rock, steel and concrete which leads the road northward underneath Park Avenue. Beneath the main roof are two track levels. Through trains use the upper level 20 feet below the street. After these trains arrive they are hustled back out from the Terminal, through the tunnel blinking with vari-colored signals, to Mott Haven Yard, five miles north. This



Above, the handling of thousands of reservations daily involves complicated bookkeeping. To handle mere cancellation of reservations for a recent month, for example, this office used up a total of 3,341 man-hours



Above, an emergency staff is ready to combat fire or injury. Below, the Mott Haven Yard, five miles north of the station in the Bronx, where all trains are cleaned, serviced and stocked before returning to Terminal





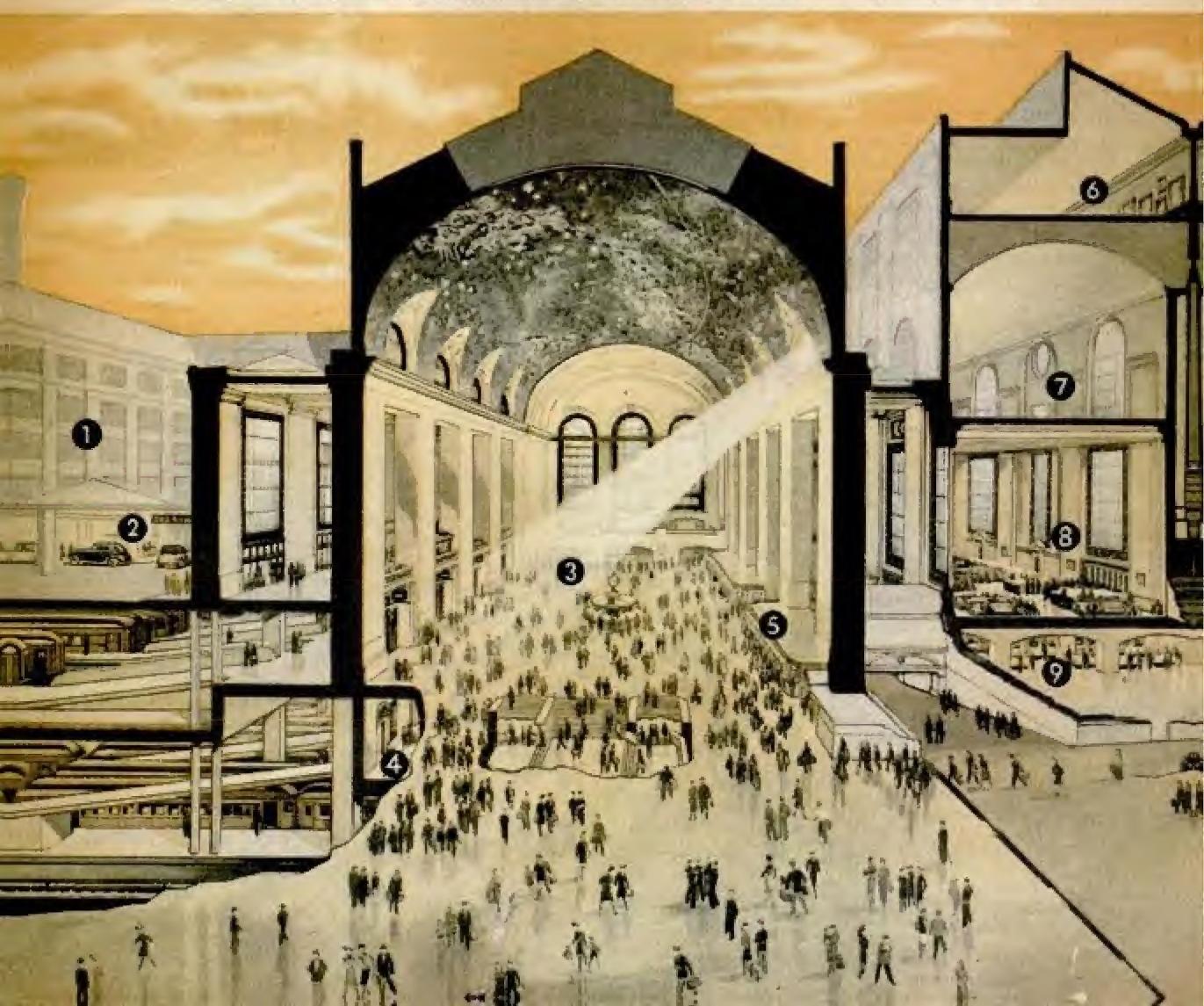
Above, corner of sleeping deck adjacent to Traveler's Aid Service Lounge. Eight hundred men every week are given free sleeping accommodations in the station. Below, cutaway diagram showing the layout of Grand Central

open-air yard with its 23 miles of track is really an adjunct of the terminal. Here such services as car cleaning and washing, icing of water coolers, changing of linen on the pullmans and stocking of the diners is performed.

Day coaches on the shorter haul trains and the suburban trains generally use the lower level, 44 feet below the street. After arriving, they are turned around on two loop tracks, swinging in a wide arc under the terminal concourses.

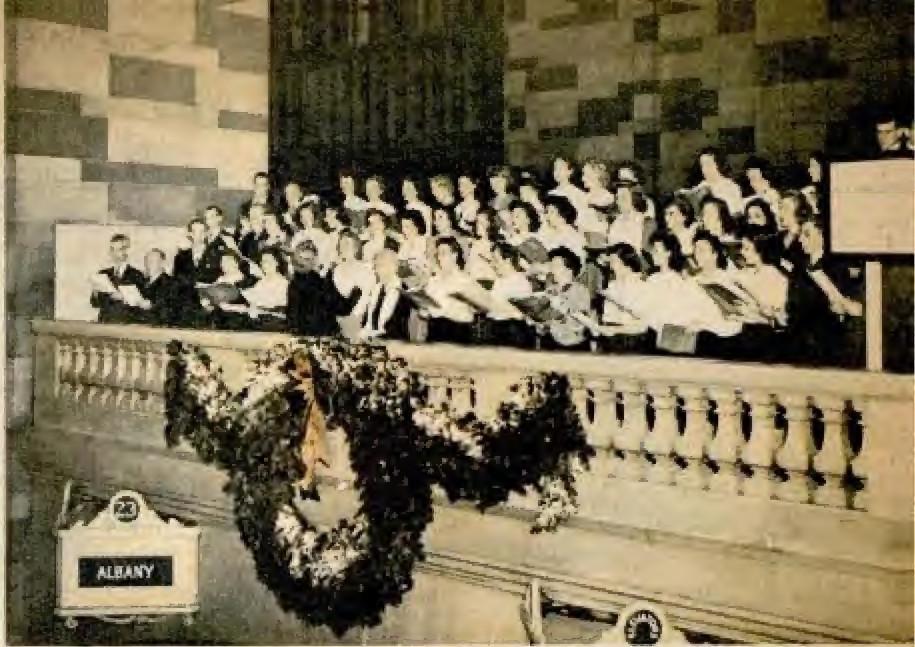
Extending from the terminal to the yards is one of the busiest four-track stretches in existence, with traffic handled successfully only because the intricate signaling system permits two-way movement on any track according to the direction of the heaviest flow.

Interlocking signals which guarantee safety



are controlled from eight towers between Grand Central and Mott Haven yard. The terminal network of tracks is governed from a four-story master tower in the middle of the underground yard, the brain center for both terminal levels.

In Grand Central Terminal the service uniform receives considerations unheard of in peacetime. In ten months more than 1,200,000 servicemen were guests of patriotic organizations active in the terminal. The Travelers Aid Society Lounge handles more than 100,000 a month. Men are given sleeping chairs, blankets and tags which state the time they are to be awakened. Cigarettes are free. Books and writing materials are furnished. Free billiard rooms are always open and entertainment includes movies and singing.



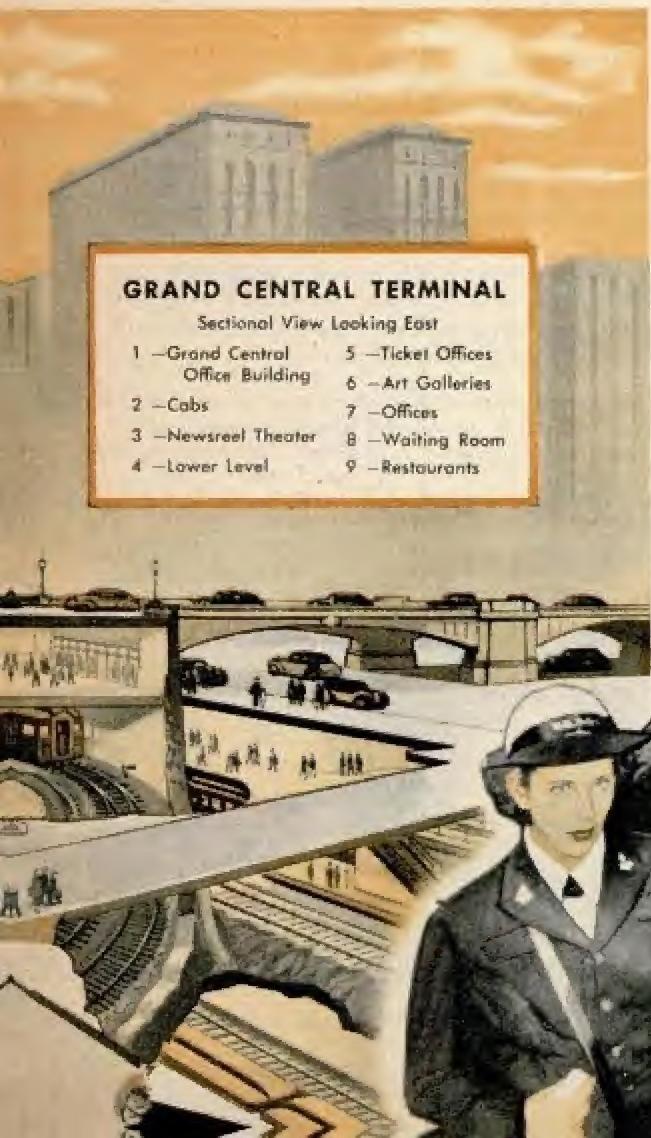
The choir provides music for servicemen and women on holiday occasions

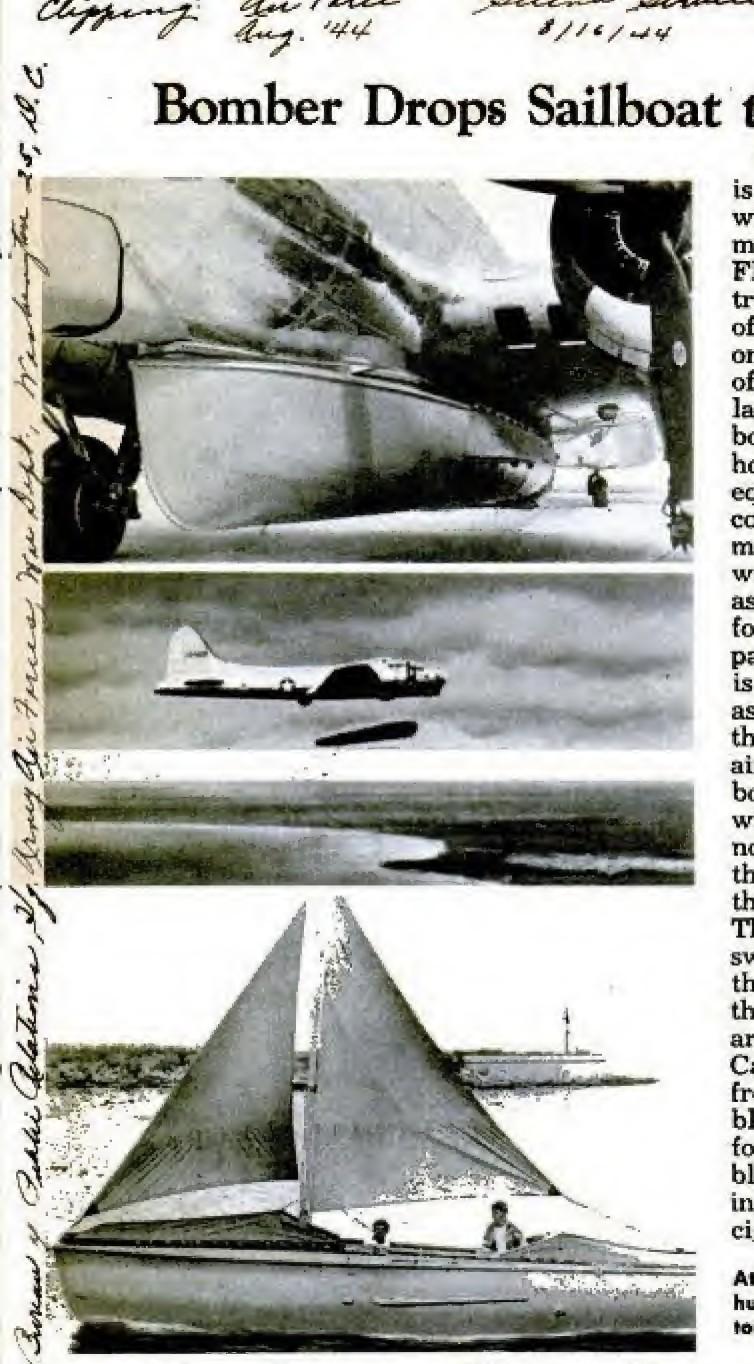
Railroad men say that as a result of the wartime migrations, this will be the "travelingest" nation ever seen in postwar times.

Thousands of servicemen took their first long railroad trips as guests of Uncle Sam and thousands more of war workers, who had never before ridden trains, had this experience in moving to war plants. The migratory workers who used jalopies to go from job to job are now confirmed train riders because of the gasoline shortage.

Postwar travel is expected to be less than the wartime crush, but more than prewar levels. But whatever may come, one thing is sure: Grand Central can take it.

Groups of WAVES often add sparkle to station's crowd scenes
New York Central photos





Bomber Drops Sailboat to Rescue Men at Sea

They call it the "Flying Dutchman." It is a 27-foot power boat fitted and stocked with all the necessities of life for a 1,500 mile cruise. Riding under the belly of a Flying Fortress or a B-29 or an army transport plane, it is carried to the rescue of men adrift at sea and parachuted down on three 48-foot "umbrellas" from a height of 800 feet. The one-ton craft fits the fuselage of a B-17 so snugly that it reduces the bomber's speed by only eight miles an hour. The boat is built of plywood and equipped with twin five-horsepower air-cooled gasoline engines and fuel for 400 miles, the engines also operating two salt-water stills. Their hot cylinder heads serve as stoves for cooking food. A portable 20-foot mast and 145 square feet of sail are packed aboard. Among the unique features is a smokepot that is set off by a static line as the "Flying Dutchman" parachutes to the sea, enabling the floating survivors of aircraft or shipwreck to find the rescue boat even in 30-foot waves, which the craft withstood in Air Force tests. Another innovation is a pair of 150-yard buoyant lines that are shot by rockets from each side of the boat automatically as it hits the water. These are set off by saltwater immersion switches. With the help of the two lines, the drifting men can pull themselves to the boat. Fore and aft of the open cockpit are shelters for protection against the sun. Carbon dioxide cylinders provide safety from capsizing. Other equipment includes blood plasma, medical supplies, canned foods, fishing tackle, air mattresses and blankets, warm and rain-repellent clothing, signaling and navigation instruments, cigarettes and chewing gum.

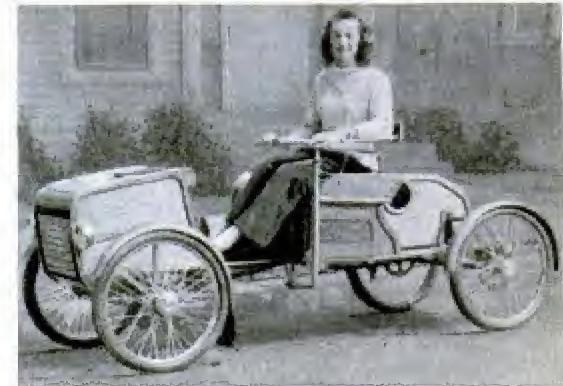
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At upper left the "Flying Dutchman" is fitted to the hull of a B-17; center, the boat is dropped. At bottom, it's "on its own" with motors and auxiliary sail

Two-Passenger Victory Buggy Gets 85 Miles Per Gallon

One man solved his wartime automobile worries by constructing a two-passenger Victory buggy which is a cross between a bicycle and a station wagon. The midget car weighs 225 pounds, is powered by a 1½-horsepower gasoline engine and uses regular 24-inch bicycle wheels and tires. The natural wood finish is similar to that of a station wagon. Controls on the car are of conventional type, but it is steered by a side lever. The engine is located in the rear, and the wheels are driven by bicycle chains and sprockets. The builder, Warren J. Bauman, of Lock Haven, Pa., reports that the car will travel 25 miles an hour and gets 85 miles per gallon of gasoline.

38 Warren J. Bauman
116 Second St.
Lock Haven, Pa.



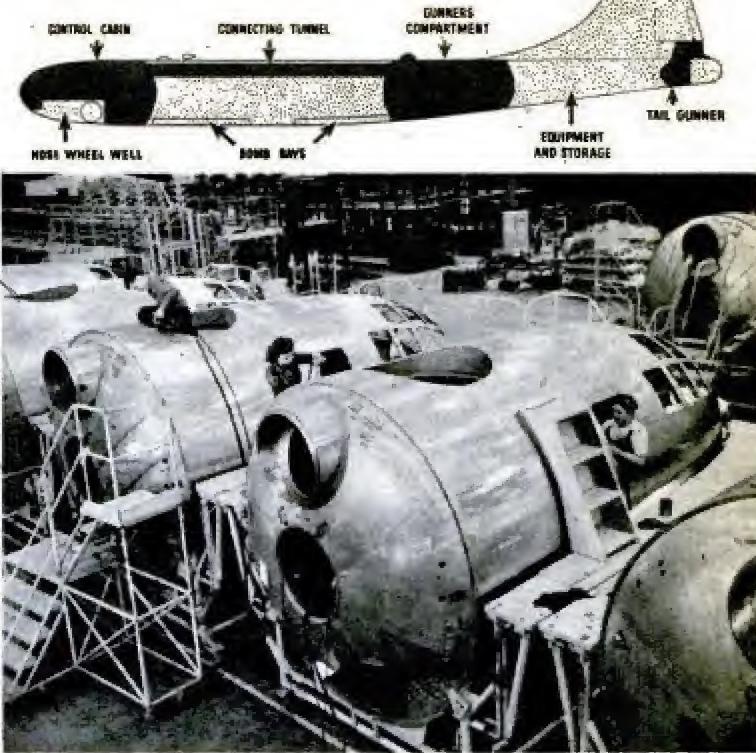
Midget car with bicycle wheels has engine in rear

POPULAR MECHANICS

O 478

Pressure Cabin in B-29 Is Linked by Tunnel

Superfortress crews can fly for hours in the substratosphere without the fatiguing effects of high altitude flying, due to the B-29's pressurized cabin. Details of this cabin, recently released by the War Department and the Boeing Aircraft Company, show that it is in three sections. Nose and waist sections are linked by a tunnel passing over the two bomb bays which are not pressurized. The third section in the tail is isolated from the other pressurized parts. The cabin is cylindrical in shape, rather than the usual oval, to assure even distribution of the tremendous pressure, and the bulkheads are rounded. An automatic regulator maintains interior pressure equal to about 8,000 feet regardless of altitude, and the compressed air is piped into the cabin from a supercharger on each inboard engine. Automatic air-conditioning is another feature. When heat is needed, a temperature control valve directs engine exhausts against the incoming air duct, and for cooling, air from outside is directed to the conditioning unit. All skin joints on the B-29 are sealed to guard against leakage of air, and specially designed gaskets prevent any leakage where control cables pass through bulkheads.



When a Superfortress crew goes into combat or is endangered by antiaircraft fire, the men don heated flying suits and oxygen masks which can be plugged in quickly. The pressurized cabin on the B-29 is the product of thousands of hours of research by Boeing and AAF engineers. It is somewhat similar to the cabin on the Boeing-built Stratoliner, the first transport plane to have a pressure cabin.

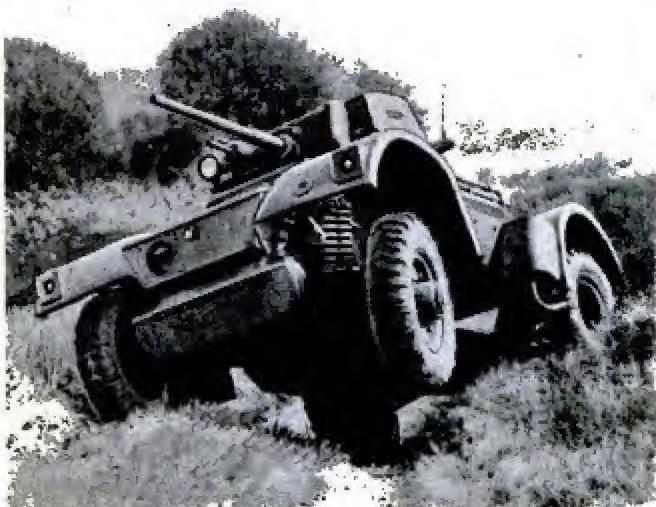
O 426

Fast-Moving "Mechanical Ant" Scout Car Steers From Either End

Heavily armed and armored, a tank-like British scout car built by Daimler engineers has five speeds both forward and in reverse and can be steered from either end. Speed, punch and mobility were emphasized in designing the car, which is used to

dash into tight corners, assault gun posts, and sometimes retreat in a hurry without turning around when the opposition gets too hot. Called the "mechanical ant," the car grips the terrain so well that it creeps over shell craters, along deep ditches and

up their steep sides, and over sodden ground that only creeper track vehicles have been able to traverse. To avoid wheel spin, the vehicle is driven on all four wheels and to reduce the degree of tilt on uneven ground, it has independent spring suspension on all four wheels. It will not turn over even when tilted to an angle of 60 degrees. Weighing about 15,000 pounds, the whole mechanism sits inside a wheelbase of 8 feet, 6 inches and a track of 6 feet, 6 inches. Above is a squat, revolving turret in which is mounted a two-pounder gun, a 7.9 mm. Besa gun and a Bren gun on an anti-aircraft mounting.



MONSOON SALVAGE



After a belly landing in a muddy rice paddy, landing gear is let down and the P-40 is pulled out of the mire by Indian coolies. Below, the rescued plane is disassembled on river bank for barge trip

By
Maj. Thomas H. Moriarty

Air Service Command

ON THE budget books, a P-40 is listed at \$50,000. In the air of Asia, that trusty fighter, still champion of them all for total victories against the enemy, could be listed at five hundred grand or five million dollars for that matter, depending on how many red balls of Japan were hanging in the sky over your airstrip or around your helpless transport as it flew toward the Hump.

There's one P-40 today that by ordinary figuring should be a debit of fifty grand, and it was the Air Service Command, expert in salvage, that beat the monsoon and multiplied the intrinsic value of the ship to ten or a hundred-fold.

It was late in spring when the monsoon broke unexpectedly over East Bengal, near the battlefields of Kohima. A pilot of Col. Phil



Photos by
Lt. CHARLES W. DUNKIN
Air Service Command

POPULAR MECHANICS



Cochran's First Air Commando outfit was cruising in his P-40 when he ran into this fire-hose velocity rain and wind. The pilot streaked down for an emergency landing with wheels up.

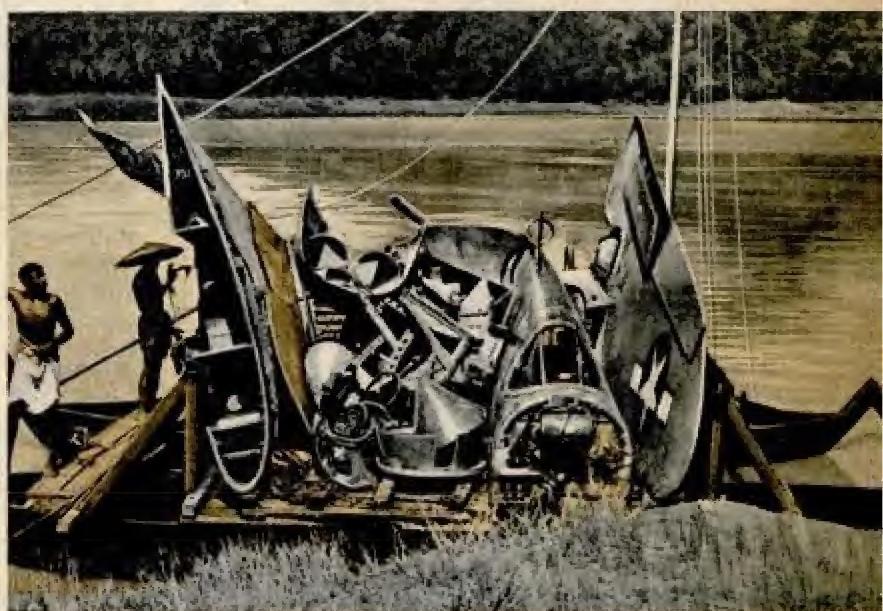
In the drenching rain and violent wind, the pilot sat under his canopy for hours. Then the monsoon moved on and he saw the ship was mired in a rice paddy, more water and mud than earth. He hitched up his boots and climbed out, with the mission of reaching the nearest village and contacting the Indian police.

In a short time Col. H. M. West, Jr., Commanding Officer of an Air Service Command "service group," received a telephone call. There was a fighting ship down on some uncharted spot. In the China-Burma-India Theater it was Air Service Command's job, along with airplane maintenance and aircraft supply, to find that ship and salvage it.

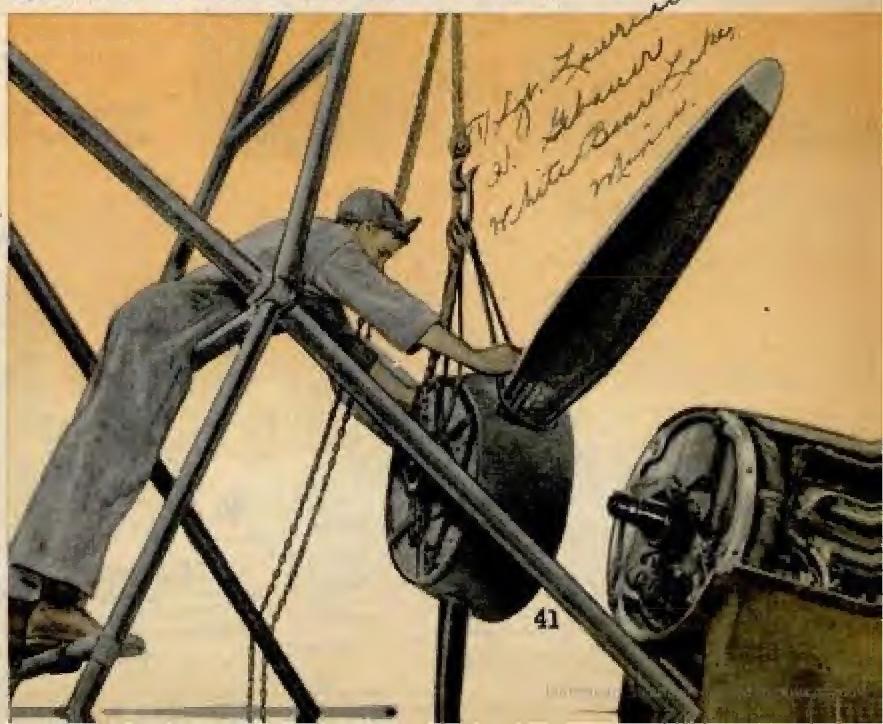
The Colonel called his trigger men on jungle salvage, Capt. N. R. McMarn of Fremont, Neb., and Capt. Charles L. Davis of Lake-



The engine removed from the P-40 is trundled over two miles of mud on a cart constructed from landing wheels of a salvaged airplane



What looks like a mass of junk, above, is the disassembled P-40 on a barge, ready for day and a half trip to railroad. Below, aircraft repairman at a Middle East air depot installs propeller on a P-47





Mechanics go to work on an extensive repair job on a big bomber at a Ninth Air Service Command station



land, Fla., his assistant. The men rolled out the observation airplane and waved goodbye to Maj. Wayne L. Ramsey (Madison, Wis.), who was to follow with a detachment of ASC enlisted men. Each man a master short-cutter of precious repair time, a genius at improvisations.

From the air; McMartin and Davis saw the P-40 was sunk in the paddy. There was not a road or trail near it. However, there was a stream about two miles from the ship. The captains decided to find a fairly dry bivouac spot adjacent and then, somehow, move the airplane out of its hole. The transportation problems were a specialty of Major Ramsey and his airmen.

Returning to their field, the men found Major Ramsey with a "mechanic commando" staff that included Lieut. Billy D. Prescott of Meridian, Idaho, Finance Officer, whose pouch was fat with rupees and annas to hire Indian coolies and rent river barges. Before long, miles had been negotiated and another ASC Command Post, typical of many river and jungle and mountain salvage bivouacs, had been established "somewhere in India." Setting out across the mud with their tools, the detachment soon became a walking rescue party, knee-deep in mud and steaming. They found the plane "dug in," Cochran's pilot had been lucky, and only beautiful handling had kept the ship from bellying-over and burying him plenty deep.

"We'll take her engine out first," the major said. The ASC lads already were setting out the tools to loosen the power plant. The heavy engine offered a problem of leverage, with the soft mud not helping any. Bamboo poles, in the shape of an "A," were the answer for an engine hoist rigging.

In a little while the men heard the high-pitched chatter of natives. Their appearance was a welcome sight, for the coolies would be needed. However, the risk from

Salvage trucks and boats (left and below) are called on to save whatever is left of a wrecked airplane



curiosity was now present, so the detachment built a bamboo fence around the airplane. In addition to keeping the natives at a distance, the fence was a guard of sorts against wandering elephants, bullocks, or water buffalo.

On the first hoist-out of the engine, whacko! went the bamboo "A" frame. Too much weight. Another "A" frame was immediately constructed, reinforced, and a jack-of-all-trades cart, another ASC improvisation, was trundled over from camp. This cart was formerly the landing gear of another salvaged airplane. Its big tires are ideal for the oozy mud and long grass of India. With the cart's support, it remained only for the Indian coolies to pull on the ropes, with their leverage horizontally applied on a long bamboo pole, and work the heavy power plant across the thick mud to the river bank. A three hour job over a distance of two miles!

That night the monsoon fought back and the bunks in the swaying tent appeared ready to float out with the tired sleepers. Soon the flood roared so madly that the detachment had to retreat to a more solid windbreak.

When they took up their job at dawn, the next move was to let the landing gear down, in order to use the buoyant wheels of the airplane to roll over the mud. This was accomplished by having a squadron of coolies lift the ship on their backs for sufficient seconds to permit the release mechanism to operate. Then a rope was attached to each wheel and tied to a horizontal bamboo pole. Coolie power, about twenty to a pole, pulled the airplane the tough two miles to the river in half a day.

At the river bank, a barge was waiting. The P-40 was now taken apart, into small sections to fit the narrow barge. Wings had to be disassembled twice. Soon the detachment slung its tent, K rations, tools, and cart aboard, and settled down for the day and a half of jockeying through bamboo and banana trees and mud shoals.

At the rail head on the river, an Air Service Command truck and Service Group men were waiting. Ropes were attached to the airplane assemblies and the heavy objects winched up the slope by truck power, then hauled by truck to freight cars of the Indian railway system, to be transported back to the Service Group's headquarters.

Once at the Service Center, salvage of the P-40 became a rebuilding job for the mobile shop. From propeller lock-nut to rudder, every one of the thousands of working parts, including those of the engine, was checked, inspected, tested for battle efficiency. Through this "fourth echelon" (or heaviest) maintenance work,

(Continued to page 162)

NOVEMBER, 1944

*Seaver Milow Co.
305 N. 25th
Milwaukee, Wis. O 458*

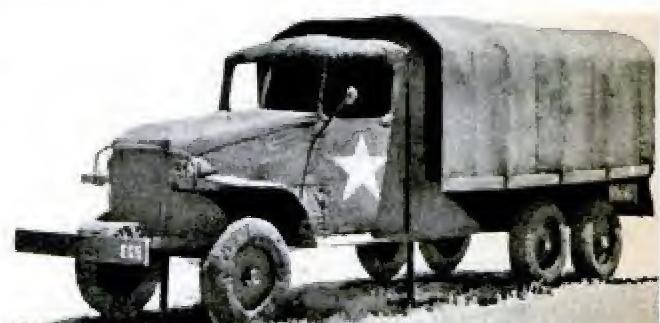


Tiller Does Three Jobs in One Without Turning Over Ground

Plowing, disking and harrowing are performed in one operation with a tilling machine which stirs and beats the ground to a depth of about six inches. Unlike a plow, the machine does not turn the ground over in the process of preparing the soil for seeding. A blade in the middle of a revolving axle works into the ground, and curved iron arms, similar to teeth on a harrow, dig into the earth and smash clods.

Dummy Truck Is "Bomb Bait" To Fool Enemy Airmen 0467

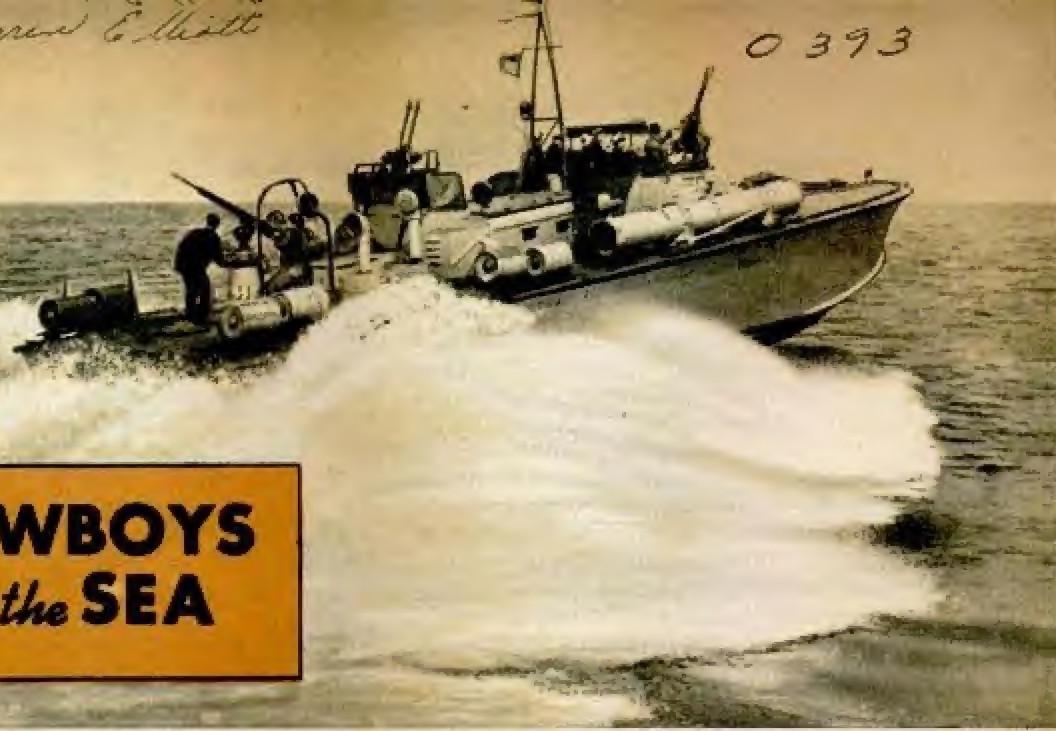
With wire, wood and burlap, camouflage artists of the U. S. Army can build a realistic two and a half ton truck. From a few thousand feet in the air, the dummy truck appears as a genuine target to an enemy flyer. He drops a bomb on the worthless dummy which has served to lure him away from the real target. Dummy airplanes and guns are also used to trick bombing crews.



*4th Air Force's Lemoore Air Field
Lemoore, Calif.*

Mr. Wm. Warner & Elliott
7 Park Ave.
N. Y., N. Y.

0393



COWBOYS of the SEA



SOME of the riproaring spirit of the old West is being revived where you would least expect to find it—on the broad swells of the oceans. The cowboys are the crewmen aboard the navy's sharp-shootin', high-rollin' PT boats.

These riders of the bucking bronchos of the waves may not be so learned in the lore of the sea—they don't have to be—but they are genuine, trigger-quick deep-water daredevils.

The 55-mile-an-hour motor torpedo boat is helping whip Japanese air and seapower in the island-hopping war of

Studying topographical map with magnifier →

Official U. S. Navy photos

PT boat roars away on patrol at 55 m.p.h.
Left, gunners on the alert for Jap planes

the Pacific. The crews have to be tougher than bomber's crews, for the going is rougher in these 80-foot wooden cockleshells than in any bumpy air of the skies. The dangers are as numerous. The hardships are greater.

At the Annapolis of this highly-specialized branch—the Motor Torpedo Boat Training Center in Melville, R. I.—one of the first questions asked of a prospective PT commander is: "What did you do in college?" Not what did the lad study, but what were his sports. The best PT boat skippers



are not only college graduates, but also former wrestlers, boxers, football men, baseball, basketball, lacrosse players or members of the rowing crew. They have to be rugged to stand the strenuous life on what the Japs call "the Green Dragons." Many PT skippers are 200-pound huskies.

The crew of 11 are lean and fit as legendary riders of the purple sage. So rigorous is the life that they speak of "riding the PTs" rather than operating them. A sudden wave will toss a man several feet in the air—even into the foaming wake of the speedster. Ankles, legs and even spines have been cracked by the slap of the deck. The boats themselves are sometimes thrown clear of the water as they smack a roller.

Some men say riding a PT in a choppy sea is like operating a jeep over a rutted log road strewn with boulders. But a good man at the helm can try to smooth things out by heading into the waves obliquely. The craft gets "rhythm" and the men learn to "lean" with its motion. However, a 10-hour run on a PT is a day's work even for an athlete.

The job of the signalman is like that of a

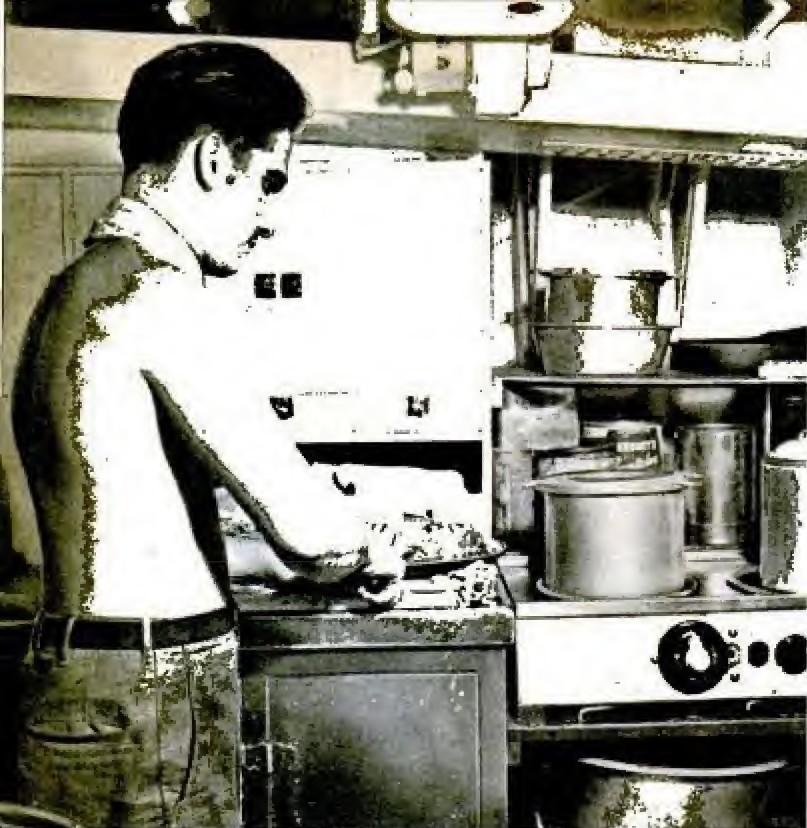
Crewmen rolling oil drums off ramp of an LCM at PT base in New Guinea

circus bareback rider atop a horse with a greased back. Needing both hands for his wig-wag signals, he either retains his footing on a wet or icy cabin-top, depending on the climate, or he goes overboard. The engineer rides a steel saddle with stirrups over a hot engine with his controls virtually in his lap.

The crew, when it isn't being whacked by icy spray or broiled in a torrid sun, is usually looking for a comfortable spot. This is hard to find in cramped space where

Awaiting the night's call to action, deadly PTs ride four abreast at river "hitching post" of tropic isle





Even a railroad chef would be cramped in galley of a PT boat

bunkroom is at a premium and most meals, though well-prepared in a tiny kitchenette, are likely to be eaten while standing up.

Amid the South Sea Islands, where the motor torpedo boats have scored their great knockout blows against the Japs, there are compensations. Much of their deadly duty is done at night and a large part of the days are spent relaxing in lush

tropical bases with good hunting, fishing, swimming and food.

The crews are likely to be stationed on a certain island for long periods and the construction of comfortable and sanitary bases is a scientific branch of navy work. Natives are friendly and willing to work. They entertain PT crews with festivals and games. The surroundings, usually an inlet or river mouth, are likely to have the makings of a jungle paradise. These bases are usually safe from Jap bombers because camouflage is easily applied to the already dense foliage. At some bases well equipped machine and repair shops and even pontoon dry docks have been established. These docks are sunk beneath a damaged boat, the water is pumped out and the plywood hull is raised for complete overhauling. Sections are sometimes prefabricated for repairs. The damaged area is ripped out and the new section quickly fastened in its place.

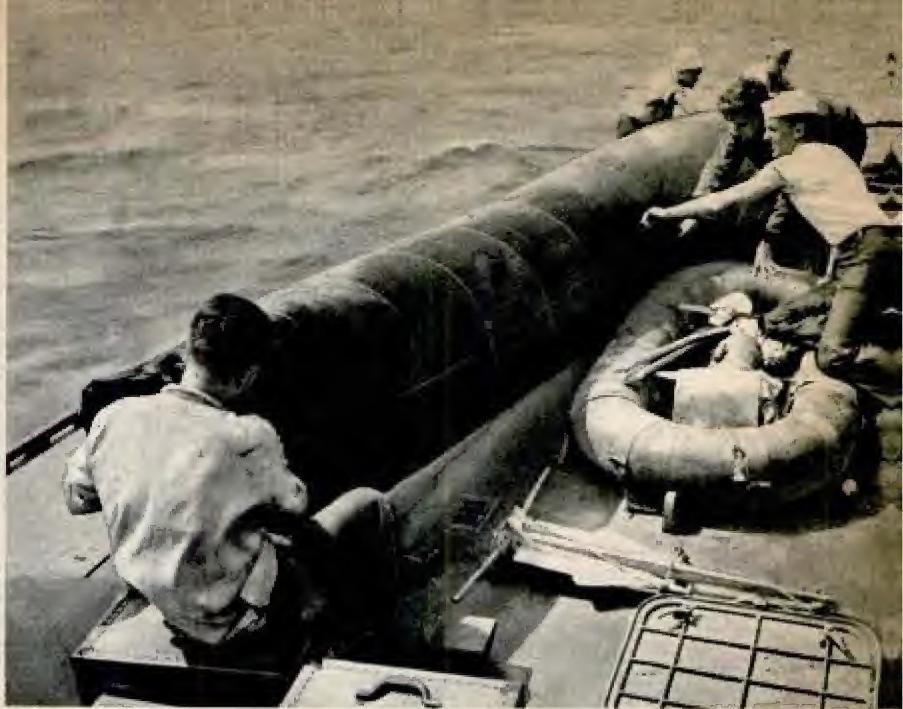
Expert mechanics are trained in maintenance of the Packard aviation engines at the Rhode Island station and are shipped to PT bases along with another set of specialists, usually officers, who have been given intensive training in selection of camp sites, sanitation, the avoidance of tropical diseases and hazards.

The PT branch of the navy is building

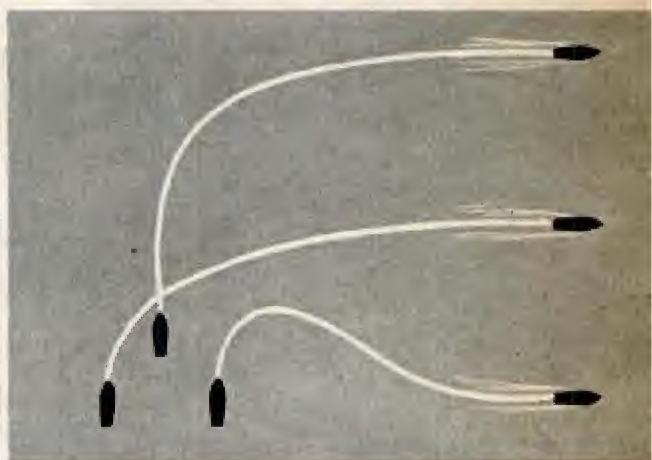
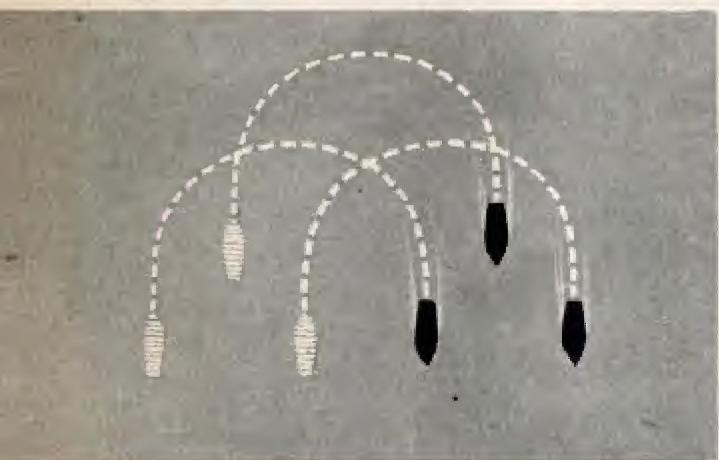
Phosphorescent wake of speeding PT is beacon for enemy airmen; boats often creep through hostile waters



up its own tactics and battle maneuvers. Usually operating in divisions of three, they use the column, the echelon and the "V" formations, the latter being the most satisfactory for both avoiding and fighting hostile aircraft and launching torpedoes. The phosphorescent wake of a PT is a give-away even at night. The cure for this hazard is to idle the boats to prevent forming a telltale "dotted line." Many PT operations are performed by stealth. They slip from cove to cove watching for a Jap warship or merchantman. Thanks to the larger ships of our navy the latter type ship is the one they are most likely



PT "cowboys" check their shootin' by examining aerial sleeve target that caught the fire of the motor torpedo boat's machine guns. Bullets used in the tests leave painted marks on sleeve to register individual hits



to find, but their stinging attacks on troop carriers and supply ships have left many small Jap detachments marooned on island outposts.

Any good skipper can dodge a bomb from a Jap bomber by waiting until the airplane gets set for its target run, then wheeling, but Zeros have a disconcerting way of gliding noiselessly down and strafing the boat. Its hull can be punctured fatally by a few bursts. But the men who slash the hulls of wood are learning to beat the game the hard way.

Training films teach basic maneuvers. Left, in counter-marching from V-formation all units turn simultaneously. Right, getting into formation to fire torpedo. Below, decks of PTs bristle with depth bombs and guns



Mr. C. N. Moore
1362 N Dearborn
Chicago, Ill.

0459

KITES go to WAR



Courtesy U. S. Maritime Commission

Whoever heard of going to school to learn to fly a kite? The answer: hundreds of men in the Army, Navy and Merchant Marine. The kites are used in aerial gunnery training (above), as protection against air attack over merchant ships, and on life rafts to carry "Gibson Girl" radio aerials aloft

Left, class of officers at Maritime Commission's Kite and Barrage Balloon School in New York learning construction and operating principles of large size balloon



Navy photo

Navy gunners call this one "enemy" because it has silhouettes of planes painted on it. It can be looped or do figure eights. The kite, painted bright yellow, is 10 feet square.

Army Air Forces photo

POPULAR SCIENCE

Army Hospital "Assembly Line" Builds Planes!



Department "99" of the Northrop Aircraft Company is located in the Army's Birmingham General Hospital, Van Nuys, Calif. This department, manned by convalescent veterans from North Africa, Italy, France and the South Pacific, is turning out parts for Northrop's Black Widow night fighter, the P-61. Equipment is adapted to the limitations of the patients. A drill press ordinarily operated by two hands is equipped with a foot pedal so a one-armed veteran can operate it. Work benches are made at wheel-chair height, and in some cases are brought right to bed patients who do sorting, inspecting or assembling of vital small parts. Special pulleys, conveyors and straps are used on this unique assembly line which is under the supervision of regular Northrop personnel. New patients who wish to engage in aircraft production work receive a preliminary training course of about a week. They learn shop nomenclature, the use of hand and bench tools, how to identify materials by color code, the use of measuring instruments and other primary skills. This experiment in physical therapy is said to produce amazing results, for the patients respond far more

Patients in Army hospital (top left) are trained by Northrop personnel. Above, special work bench designed for bed patient. Below, inspecting P-61 part



readily than they have in the past to making dolls and weaving baskets. They are not only contributing to the war effort by making thousands of P-61 parts, but are acquiring practical skills.

O 474

Navy Blimp Reverses the Pitch of Its Propellers to Serve as Air Brakes

Reversible propellers act as "air brakes" for the Navy's new M-1, anti-submarine patrol blimp which is the largest non-rigid airship built in the United States. On the takeoff the pitch of the propeller blades—

there is an engine on each side—is deepened to take a bigger "bite" of air. For landing or hovering the pitch is reversed, and by reversing only one propeller the ship can be turned as on a pivot.

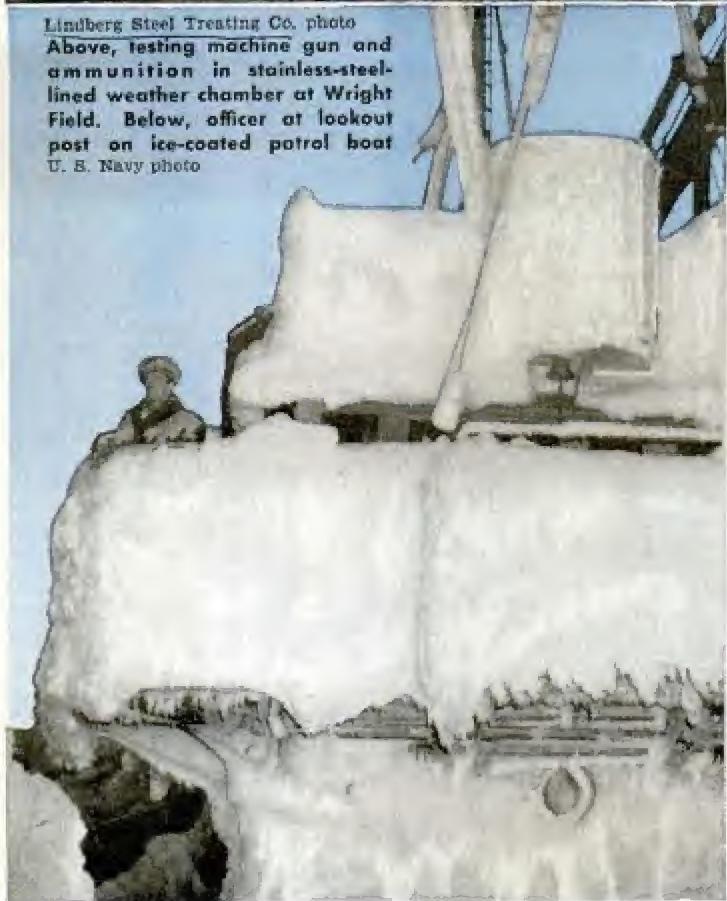
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SUB-ZERO TORTURE for METALS



Lindberg Steel Treating Co. photo
Above, testing machine gun and ammunition in stainless-steel-lined weather chamber at Wright Field. Below, officer at lookout post on ice-coated patrol boat U. S. Navy photo



WHAT happens when the mercury plunges to 100 degrees below zero?

Arctic-clad gunners at the Frankford Arsenal who test ammunition for machine guns and small arms in a room refrigerated to 70 below might have a pretty good idea of how that temperature feels.

Men in electrically heated, fur-lined flying suits and special felt masks who work in the "world's biggest ice-box" at the AAF Materiel Command laboratories at Wright Field where 95 below can be reached might hazard an even better guess.

But the engineers who create this sub-zero cold, who know how to control it, and who are learning more and more about how to use it, are little concerned with its effect on human feelings. Their interest lies in the ways this cold affects countless different materials and how it can be used in laboratories and factories to produce better

products for war and peace.

Great strides forward have been made since the start of the war in using extreme cold both for testing war products and for treating metals and other materials. In addition, sub-zero temperatures have found many other uses in industry, boosting production and reducing costs. Experiments have utilized temperatures as low as 310 degrees below zero, Fahrenheit. It has been found, however, that it rarely is necessary to go below minus 150 degrees to accomplish desired results either in treating or testing, and a range of 80 to 130 degrees below has been found best suited to requirements of cold-treating metals.

The war, which brought demands that many products for the armed services be thoroughly tested at low temperatures for use in cold countries or at high altitudes, caused a great increase in methods and procedures of cold treatment of a seemingly endless list of materials—plastics, lubricants, leather, synthetic rubber, pharmaceuticals, chemicals, paints, vegetable oils, clothing and metals—to name only a few.

While cold treatment of metals, for example, and cold testing of materials are two entirely different processes undertaken for different purposes, the procedure is essentially the same, consisting of the use of cold cabinets, cold chambers, chilling machines and other devices ranging in size all the way from refrigerators the size of the average home unit and portable machines up to the Wright Field "icebox" which is housed in its own building, has internal dimensions of 25 by 25 by 80 feet and is large enough to accommodate the fuselage of a B-17 Flying Fortress or a full-sized fueling truck and trailer.

Rapid advances have been made in the design and construction of these chilling machines and freezing units. Some have holes sealed with arm-length gloves so that the



Engineer (above) removes small but powerful aircraft generator from "weather-maker" after a "flight" to 40,000 feet. Below, arctic-clad gunner tests munitions in a chamber refrigerated to 70 degrees below zero





Air Forces photo

Above, B-17's lay a carpet of vapor trails. Below, optical lenses in shell of pitch are put in a chilling machine



operators can reach inside to adjust valves or controls without interrupting the test. Many units have laminated glass windows so that behavior of products under extreme temperatures can be observed. One new type of this glass has two or more panes separated by layers of scientifically cleaned and dried air and held together with a patented metal-to-glass bond. The Wright Field chamber has eight panes of glass in observation windows to prevent frosting.

and to seal in the cold air. In numerous units, openings are provided for bringing in electric power or compressed air, as might be required in various tests. In other units cold treating has been combined with features designed to reproduce exactly climate conditions encountered in all parts of the world and atmospheric conditions at high altitudes.

Both Dry Ice and mechanical refrigeration are used to produce the low temperatures required. In one unit, used by Westinghouse, half a ton of carbon dioxide Dry Ice is crushed and dropped into a tank of varsol, a low-freezing-point fluid ordinarily used in dry cleaning, in a single stratosphere test. The big Wright Field unit has five engines to provide power for the refrigerating unit.

Some of the cold tests of war materiel are both interesting and spectacular. The 70 below test of munitions at the Frankford Arsenal, for example, is described by Maj. Walter E. Monagan, Jr., public relations officer, as the most dangerous job at the arsenal—more so than powder loading or work at the ammunition dumps.

"You can't always be sure what metal will do when the outside of the barrel is 70 below and the inside is heated by the firing of the gun, but the testers find out," he said.

At the St. Louis Ordnance Plant, 50-caliber cartridges are "soaked" for 24 hours in a chilling machine at 70 below before

test firing. Even the protective coating of ignition cables gets severe tests for flexibility at 60 below or colder.

The use of high altitude face masks worn by air gunners was not sufficient to protect the men working in the Wright Field chamber, sometimes as long as three hours at a stretch. The problem was solved by the use of felt masks, with the felt thick enough to keep body heat inside the mask circulating about the face. Since moisture does not condense readily on felt, there is less danger of moisture freezing on the masks.

What may be of more far-reaching industrial importance than cold testing, however, is the progress made in cold treating metals. As a result of "freezing," for example, some remarkable increases in service life of cutting tools have been recorded. There are instances where tool life has been extended as much as 100 percent after two to three hours treatment under a temperature of 120 degrees below zero, Fahrenheit. "Chilled" milling cutters have withstood 24 hours of continuous service instead of seven; hack saw blades, frozen at better than 100 below, have lasted up to 119 percent longer; cold treated



Above, oxygen mask is tested in low-pressure chamber at Naval Medical Research Institute. Below, cracking an ice formation with a baseball bat on a U. S. Coast Guard cutter





Coast Guard Academy cadets wear masks during bitterly cold cruise

drills, formerly cutting around 50 holes before resharpening, have cut more than 250 holes after refrigeration, and so through a long list of similar examples reported by manufacturers.

The freezing process with tool steels, as with other metals, is entirely supplementary to the usual heat treating and conventional hardening. The most common practice with high speed steel is to cool the steel directly from the heat treating quench down to 110 degrees below zero, using a continuous cycle to control the rate of cool.

Strangely enough, metallurgists do not know yet precisely what happens to metal when it is exposed to extreme cold, although there is known to be a change within the crystalline structure contributing to making the metals harder, stronger, or more ductile. This change is believed to be something of a continuance of the effect produced by heat treatment, and it is conceded that conventional heat treatment alone frequently fails to develop uniform metal structures.

One authority on the use of super cooling of hardened steels, G. B. Berlien, chief metallurgist, Lindberg Steel Treating Company, Chicago, says that with the cold treatment process all steels first are conventionally hardened. He describes one process like this:

Right, a coupling bolt pre-shrunk in a sub-zero bath of Dry Ice and alcohol is inserted into waterwheel generator hole. Bolt then expands to original diameter

"High speed steel, as an example, is given one or two preheats, whichever the practice might be, and then brought up to the regular hardening temperatures. Then it is quenched in oil, lead or salt, cooled in air to about 200 degrees F., and transferred to a refrigerating medium.

"To realize the full value from this process, the tool is cooled directly from the quench in a continuous cycle, right down to 110 degrees below zero. It would not hurt to cool the tool lower, but the advantages are not great enough to warrant additional cool-

ing equipment. An average of 120 degrees below zero will develop the greatest degree of sub-zero martensitic decomposition, or as-quenched structure breakdown. The tempering operation then follows to reduce the high hardness to a workable range."

Mr. Berlien declares that exhaustive research has revealed that temperatures of 80 to 130 degrees produce all structural changes in steel that might be expected. Temperatures lower than 150 degrees may cause cracks, and levels higher than minus



80 degrees are relatively ineffective, he said.

In metal working, numerous other important advantages of sub-zero treatment have been developed. Shrink fitting of metal parts now utilizes cold for contraction as well as heat for expansion. Foundry castings and other metal products which are to be "aged" or "seasoned" are subjected to low temperatures to speed the process. Some foundries are substituting cold treatment for outside storage in winter, with obvious savings in time. Gauges, formerly requiring years to treat, now are aged in only a few hours, and annealed aluminum rivets and aluminum sheets are stored under low temperatures so they will remain soft after quenching and easily workable.

In the case of aluminum rivets, it was found that a difference of only 30 degrees meant the difference between success and failure of the cold treatment. If the temperature is an even zero, the rivets harden in only a few hours. But if the mercury is at minus 30 degrees, the rivets are kept in the soft quenched state for two to three weeks and thus are readily available in quantity when needed.

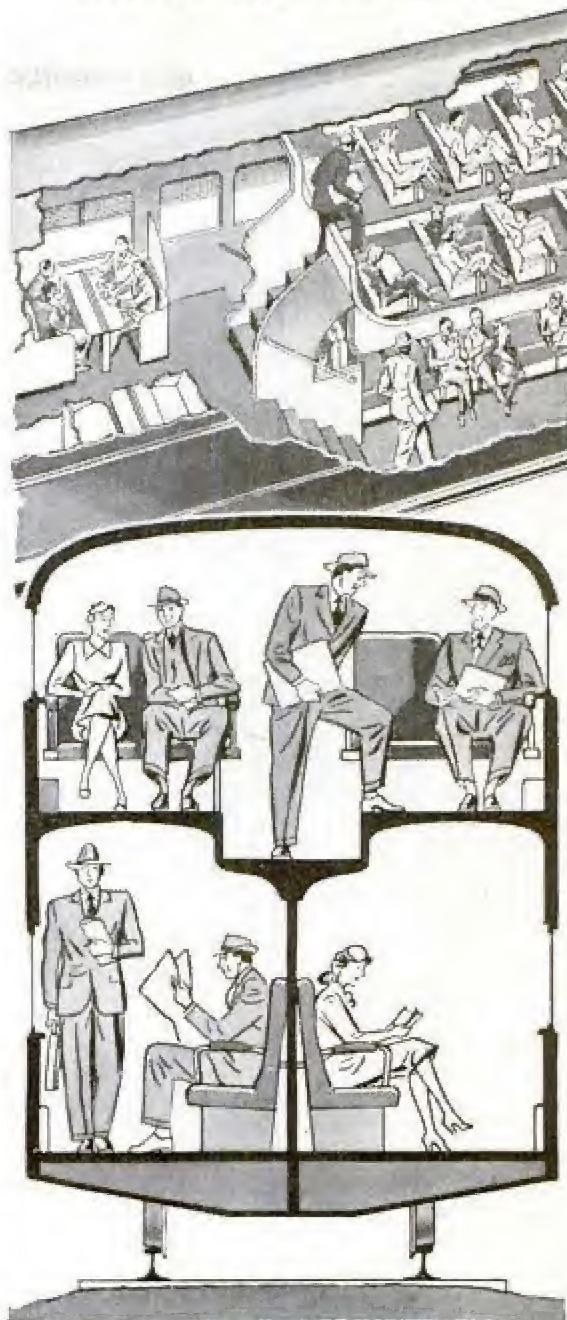
Production of optical lenses has been boosted considerably by several producers by freezing the pitch which holds the lenses on the blocks for final grinding and polishing. Formerly, the pitch was melted off—a slow process requiring subsequent cleaning of the lenses with a solvent. Often, too, the glass was damaged. Now the pitch is frozen and when it shrinks the lenses are lifted off easily and cleanly. About 70 percent is saved in time alone.

With small parts, it has been found desirable in shrink fitting to use both heating and chilling, with extreme and possibly damaging temperatures being avoided in either direction. Cold cabinets with automatic feeds have been set up near production lines for mass production of motor vehicles. Here valve inserts in cylinder blocks and wrist pin bushings for pistons are chilled before fitting. In one airplane factory, output in a department was doubled with a single mechanically refrigerated unit which freezes one part of a landing strut at 70 below for shrink fitting.

The Bendix company alone uses cold testing or cold treatment in several of its plants in the production of more than 70 basic types of flight and navigational instruments and aircraft engine component parts and accessories. Tests are conducted as low as 70 degrees below zero.

(See the index to find where to buy articles described in this magazine. Say You Saw It in Popular Mechanics.)

Rail Coaches With Three Decks Will Seat More Commuters



Postwar plans by Pullman-Standard call for "Threedex" railway coaches for commuter trains. The design is expected to increase capacity of the coaches to 112 passengers, one and one-third times the capacity of today's typical commuter coach. Each car will have three levels. Passengers will enter at either side on a middle level and ascend a central stairway to the top deck of seats or descend two side stairways to the lower deck. On the middle level will be four game rooms, where 16 commuters can play cards on the way to the office.

Or Car Mfg. Co.
79 C. Adams St.
Chicago, Ill.

"Disintegrator" Grinds Metals Into Powder for War Uses



Anything a steel saw will cut—from hard metals to soft foodstuffs—can be ground or pulverized into fine powder by the thousands of teeth in a disintegrator's steel drum. The machine is equipped with a mechanism to regulate the feed and can be adjusted to various speeds and size of powder, grit or shred. Among the 41 materials the machine can handle are lead, bone, plastic, copper, wood, rubber, soap, leather, tar, chicle, cheese, horseradish, oranges and cast iron. Technological developments are widening the uses of powdered metal in such war necessities as press castings, paint pigments, and similar materials.

0432

"Hot Sandwich" Ice Preventive Made of Conductive Rubber

Airplane propellers whirring at stratosphere levels can be kept free of ice by means of an electrical "hot sandwich" developed by the Goodyear Tire and Rubber Company. The covering consists of a rubber boot made up like a sandwich from

11446 Market St.

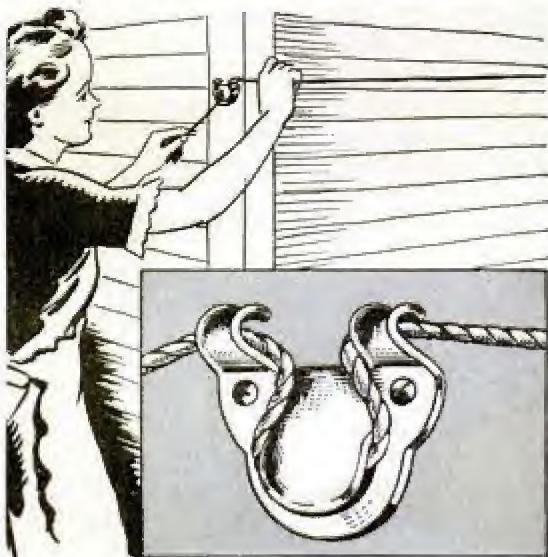
Akron, Ohio

three layers of specially compounded synthetic rubbers which fits over the leading edge of the propeller blade. The boot, which weighs about one pound, is only a few thousandths of an inch thick. The center layer of the sandwich is of rubber that conducts electricity. It is made by forming continuous chains of electrical conducting carbon particles through a sheet of nonconducting rubber. When current is sent through this layer of the sandwich, it grows hot and melts whatever ice has formed. The upper layer protects the boot from abrasive forces of raindrops and ice particles which tear great holes in ordinary rubber, while the bottom layer is regular insulating rubber that prevents the heat from escaping into the propeller blade. The new boot also may be used to prevent ice formation on radio aerial masts, air speed indicators, wing tips not accessible to hot-air heating, tail surfaces and engine cowlings.

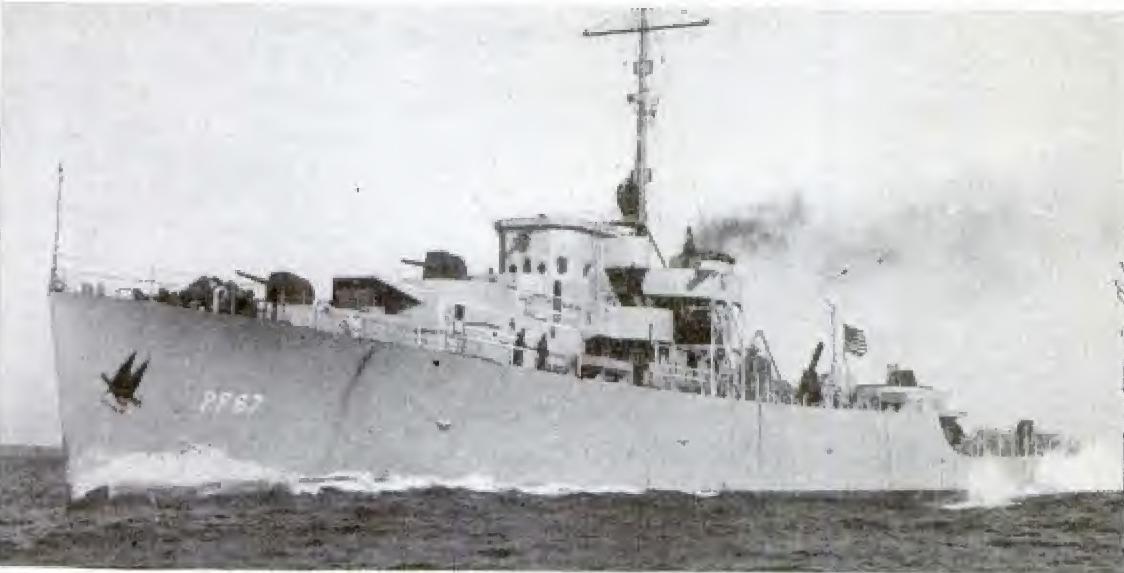
0424

Self-Grip Clothesline Hook Eliminates Knots

Knots are eliminated in putting up a clothesline with a hook which can be fastened to round or flat surfaces. The hook, or clamp, holds the line in the shape of a U with the lower part consisting of a lip under which the line passes. The harder the line is pulled, the tighter it is held by the self-gripping hook. If a line breaks when held up by a series of these hooks, only the broken section would fall.



Warships Float Down Inland Canals on Pontoon



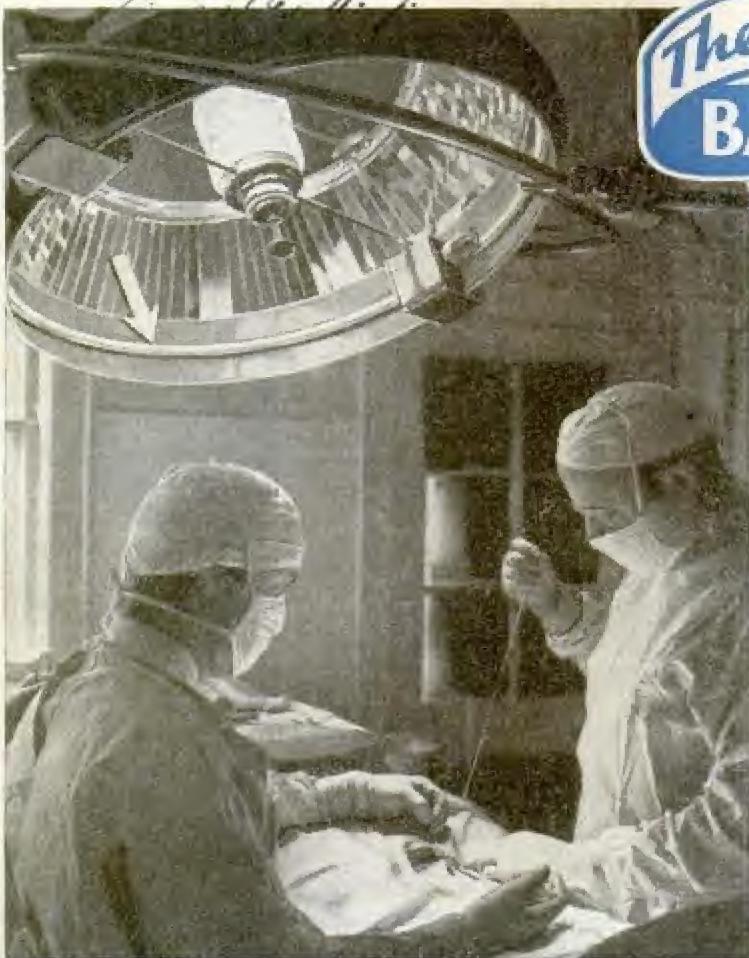
By removing masts, attaching pontoons to the stern and shipping ballast, frigates and cargo vessels up to 338 feet long are floated down inland waterways from shipyards on the Great Lakes to New Orleans. Frigates such as the U.S.S. Peoria (above) guard convoys from submarines; the cargo vessels are used for inter-island operations. With pontoons welded and bolted on both sides (right), the stern is practically lifted out of the water and the frigate can negotiate shallow canals. Because low bridges are ahead, the U.S.S. Orlando (below) stows its mast on deck before beginning a trip to the ocean. Pusher-type tug attached aft is temporary motive power. These ships can't use the usual route through the eastern lakes to the St. Lawrence River because the canals around the rapids in the St. Lawrence can only accommodate vessels up to 259 feet in length.



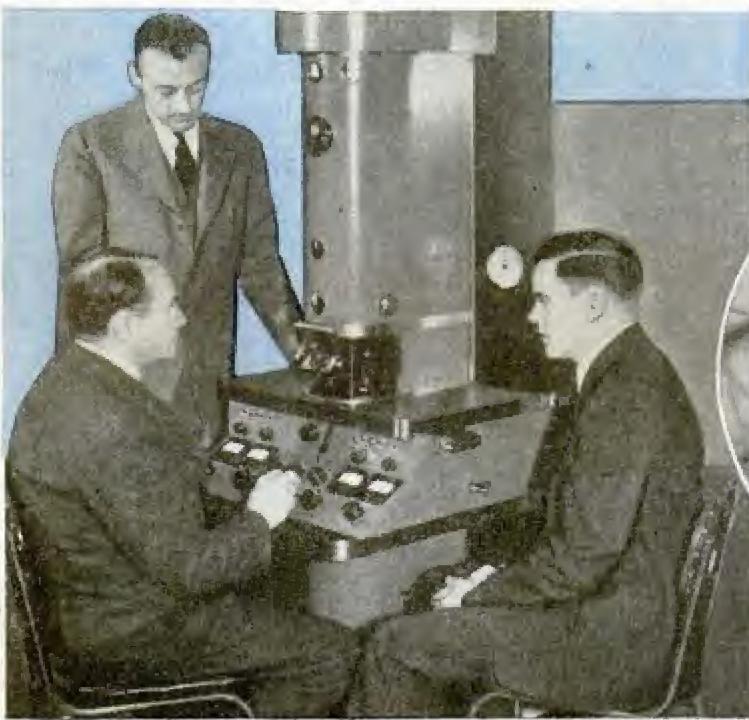
O 443
U. S. Maritime Commission, Cleveland
310 N Michigan Ave., Chicago, Ill.
U. S. Maritime Commission, Cleveland
310 N Michigan Ave., Chicago, Ill.

Mr. Allen Warren Elliott
7 Park Lucy,
21 E. 16 N.Y.

0378



The arrow points to Sterilamp tubes, radiating germicidal ultraviolet light, surrounding a shadowless, glareless Westinghouse surgical lamp



Left, RCA's electron microscope; above, electron micrograph of the scales of a malaria mosquito's wing, magnified 16,000 times

The + BATTLE against + BACTERIA +

IT IS a strange paradox that wartime medical discoveries will undoubtedly save more lives in future years than will be lost in this conflict.

It's as though we are fighting and winning a war within a war. This second war, a battle against bacteria, has armies numbering in uncountable billions and weapons so mysterious that no one knows how they work their magic.

Penicillin is the principal germicidal block-buster which is changing the map of disease. Science is starting to pit one friendly microscopic army of nature against destructive microscopic armies which have long and successfully attacked the human body. Penicillin is only a starter. During the next year it is likely that more of these "wonder drugs" from mold cultures will be announced.



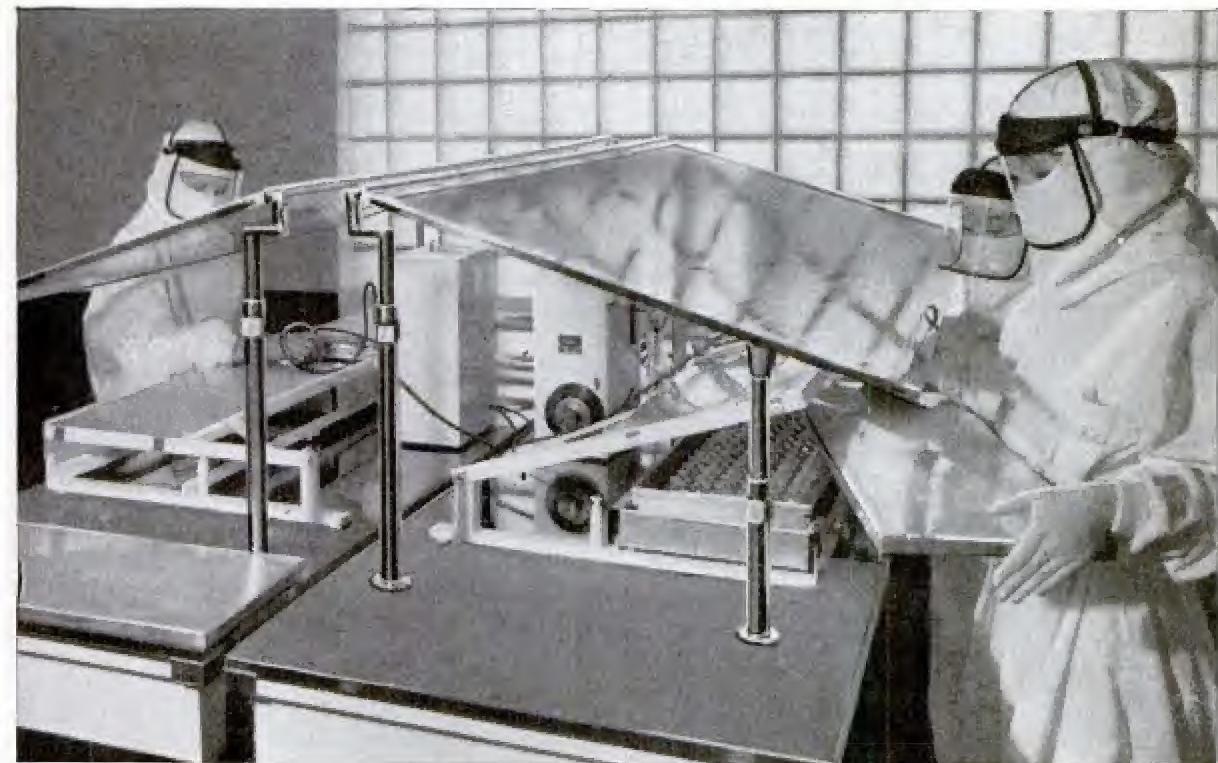
Of two ducks infected with malaria, the one at left is under atabrine treatment

Dozens are being tested. It seems likely that the very dirt in your backyard is teeming with microscopic growths like penicillin mold which provide materials poisonous to germs, but harmless to humans.

Germs from the soil, as well as molds from the soil, can be raised to kill germs. Dr. Rene J. Dubos, connected with Rockefeller Institute for Medical Research, filled three ordinary kitchen glasses with common soil. He fed the millions of organisms with cultures of laboratory germs. One day he took a pinch of the soil and dropped it into a test tube containing pneumonia germs. Through



A colony of germs growing in petrie dish at General Electric company laboratory is killed by 15 seconds exposure to ultraviolet lamp. Below, filling penicillin vials





Bottles in which penicillin mold will be grown go into sterilizer at Pennsylvania State College

American pharmaceutical companies produce the drug by introducing the mold into huge vats filled with a nourishing broth. Portions are then transferred into thousands of cotton-plugged bottles where it continues to grow in another nutrient solution. It is permitted to develop for six to ten days, and during this time it grows first as a smooth, white scum on the surface of the liquid. Then it becomes coarse and wrinkled. By the fourth or fifth day, green spores begin to appear on its surface, giving the mold a greenish gray appearance. Then tiny lemon-yellow drops may be seen on

Left, Winthrop Chemical Co. produces 800 million otobrine tablets a year. Below, workers in sterile garb make penicillin for Commercial Solvents Corp.



a microscope he watched the bacteria from the soil destroy the pneumonia germs. Thus tyrothricin was added to penicillin as an ally of man. It specializes in killing germs in body cavities, such as the chest, and on skin surfaces.

University of California College of Agriculture scientists have found two tiny soil-borne organisms which secrete an unknown substance fatal to typhoid and diphtheria germs.

Mass production has only recently permitted distribution of penicillin to the public, as well as the armed forces. It is a soil-borne mold, looking like the mold which grows on bread and cheese. To protect itself against bacteria, it produces a chemical substance fatal to them. This is the remarkable drug.



the surface, drops of oily liquid rich in penicillin.

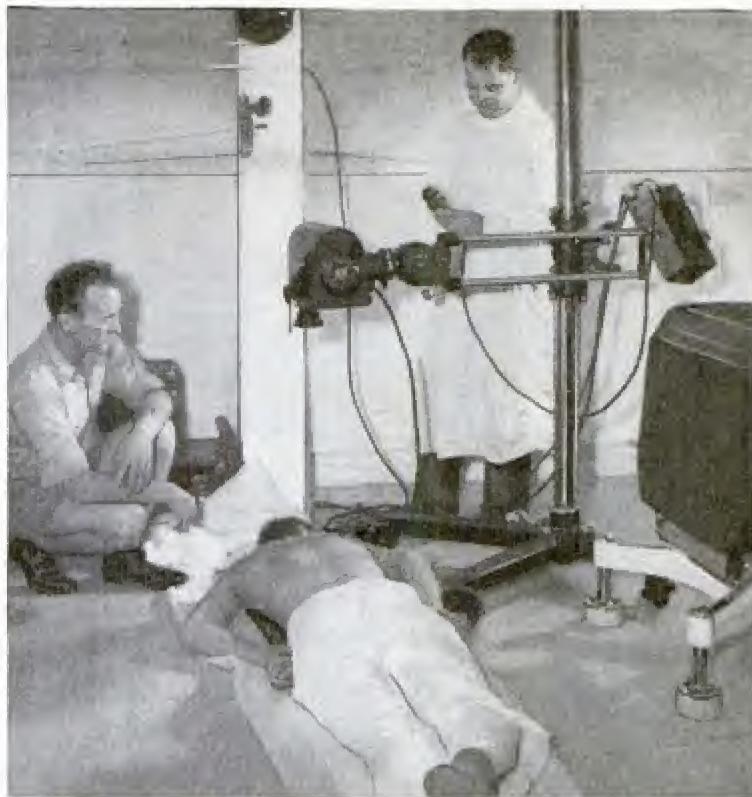
The large proportion of the penicillin is found, however, in the nutrient medium beneath the mold. This penicillin "liquor" must be poured from beneath the heavy, wrinkled mat of mold, and is the crude material from which purified and concentrated therapeutic penicillin is made.

A solution as weak as one part in 2,000,000 kills germs. Introduced into the human body or on its surface, the substance seems literally to tear the bacteria to pieces, causing their structures to crumble like a building hit by an aerial bomb.

How do scientists know this? The answer is the new, super-electron microscope, an improvement on one of the most startling inventions of the century. Here is a secret weapon in the war on germs which might be compared to a telescope in New York City which would show you what was going on in Berlin.

This new scientific "eye" has already shown 100 times greater power than a light microscope, and the peak of its usefulness has not yet been reached. Power of microscopy depends upon the length of the waves used and it is calculated that electrons may have wavelengths 100,000 times shorter than the light waves which register in your eyes. Bacteria and fungus cultures may be enlarged 50,000 to 100,000 times. An object as small as a single molecule has been photographed. Semi-portable, desk-size electron microscopes now in production will make the instrument available to more scientists.

War has not produced the long-predicted "death ray," but the war period has seen the perfection of



Our fighting ships have the most modern medical equipment available. Here a Medical Officer watches as X-ray picture of a patient is made

Diagram below, from American Sterilizer Co., indicates how "Hygeaire" ultraviolet lamp is placed on wall to kill germs circulating in office air





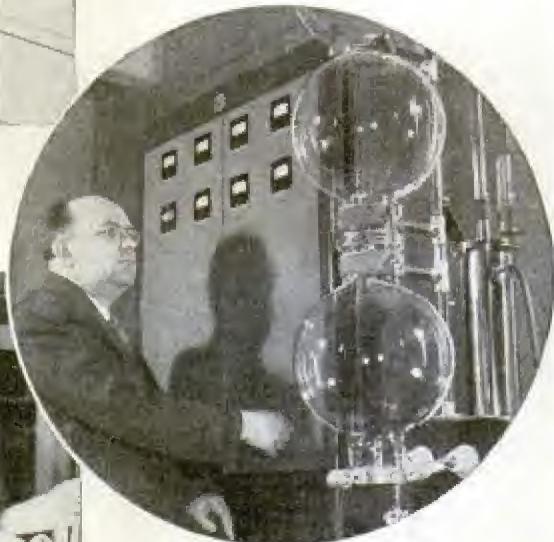
Above, portable GE ultraviolet sterilizer in doctor's office. Right, electronic heat speeds manufacture of penicillin. Below, rabbits are used for test of the fever-producing qualities of penicillin



its counterpart in the war on bacteria—ultraviolet radiation.

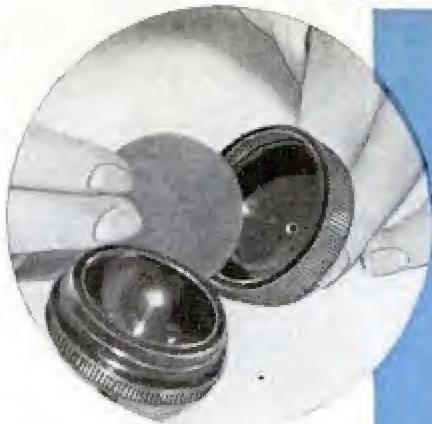
So important is the function of ultraviolet tubes that the government permits their manufacture during wartime to kill airborne bacteria in operating rooms, schools, offices, packing plants, pharmaceutical establishments, bottling rooms, and so on. These "bullets of ultraviolet light" have been found to kill certain types of virus which are believed to be the disease carriers responsible for wartime epidemics.

A new use for the tubes has been found in the preparation of vaccines. The preparations are spread in a thin, flowing film which passes under a powerful ultraviolet lamp, killing the germs in less than a second. Vaccines have been thus produced for sleeping sickness, rabies, and pneumonia.



The miraculous sulfa drugs, which have been overshadowed by penicillin, have gone steadily forward saving lives by thousands. The newest in the family is sulfasuxidine, or succinylsulfathiazole, which has a special effect on intestinal bacteria, but is harmless to man.

Strangely, these sulfa drugs do not kill or destroy germs like penicillin. Pour sulfanilamide into a culture of "cocci" and they still live, but without reproducing. In the body the same "cocci" are drugged or paralyzed. The latest theory holds that sulfa drugs interfere with the germ's nutrition, inducing starvation.



Whole blood and blood plasma are filtered through porous rubber filters (top). "Multipore" was developed by U. S. Rubber Co.

Sulfas now are injected along with penicillin, and if one does not slay the germs, the other puts them out of the fight until the body's own germ-killing troops do the lethal job.

The tremendous use of blood plasma has been accompanied by explorations in the field of blood chemistry. A derivative from blood contributed to the armed forces is becoming available through the American Red Cross for prevention or modification of measles. The gamma globulin is obtained



as a by-product in the making of serum albumin, a concentrated blood derivative, which the armed forces use in addition to blood plasma.

While the synthetics, atabrine and plasmochin were being developed in the fight against the world-wide scourge, malaria, Dr. Robert B. Woodward and Dr. William E. Doering were investigating the making of synthetic quinine. It took less than fourteen months to succeed. Their new synthetic cannot be distinguished from natural quinine. The two chemists, using common chemicals, duplicated the cinchona drug by arranging carbon, hydrogen, nitrogen, and oxygen atoms in precisely the same relationships as nature's arrangement of these atoms in the quinine molecule.

University of Chicago scientists have proved that spraying propylene glycol into the air kills airborne bacteria and will help prevent epidemics.

These new germicidal sprays can be discharged from the "health bombs" used by our servicemen to exterminate insects. The "bomb" is a dispenser loaded with liquid insecticide which is released as a fine mist.

(Continued to page 156)

Sterilizing a shoe with ultraviolet lamp to prevent spread of foot infections at a Westinghouse factory



O 500

'Doughnut' on Doughboy's Back Holds Flamethrower Fuel



Paratroopers, commandos and infantry-men carried the machinery for the "Life Buoy" flamethrower onto the battlefields of Europe strapped to their backs. The "Life Buoy," a "gun" which can throw fire 50 yards, is said to be greatly superior to its German counterpart.

O 248

Invisible Wire Made of Platinum Is 1/25,000th as Thick as Hair

Platinum wire so fine that it is invisible to the naked eye is used for engineering experiments in the General Electric Company laboratory. The wire is 13 millionths of an inch thick and approximately 25,000 strands would be needed to equal the cross-sectional area of a human hair. The wire cannot be seen if mounted between glass plates and held up to the light, although its shadow can be detected. One cubic foot of the wire would weigh 1,330 pounds and could circle the earth 8,000 times. It is manufactured by drawing out

O. H. Mara Co.
1622 N. Main St.
Racine, Wis.

silver wire with a platinum core to an overall thickness of two-thousandths of an inch. Then a section is placed under a microscope in a few drops of nitric acid and the silver dissolves away.

O 385

Wicks in a "Pin-Up" Flowerpot Keep the Plant Watered

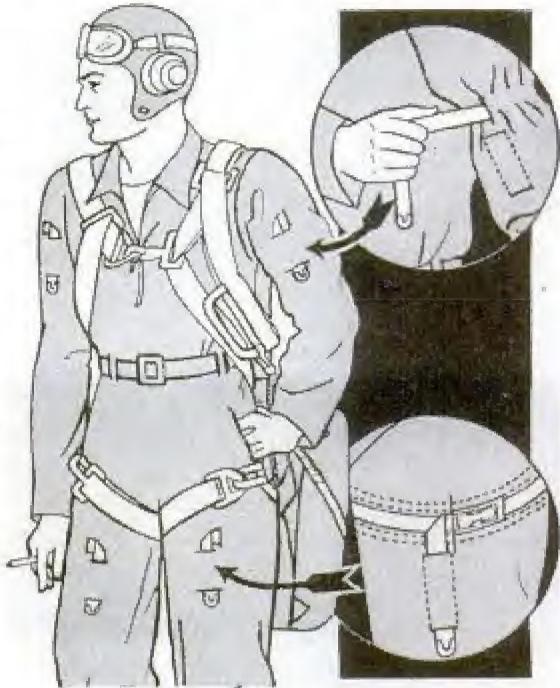
To facilitate hanging a flowerpot on the wall, it can be placed in an outer shell attached to the wall by a pinup. Instead of watering the flowers, the outer shell is simply filled with water and the plant draws water through the capillary action of wicks in the bottom of the pot.



O 499

Four Tourniquets on Flying Suit Grip Legs or Arms of Wounded

To save the lives of flyers badly wounded in the legs or arms, two naval reserve officers designed a "tourniquet" flying suit. It has four "built-in" tourniquets on the sleeves and pants. Five-inch tabs which protrude from the tourniquet pockets can be reached by either hand or, if necessary, may be tightened by the teeth. Lightweight aluminum locks hold the tourniquets tight.



Designed by
Lt. Col. Russell J. Witmer
(MC) U.S.N.C. Lt. Wm. F. Leach
U.S.A.F.

64 Schenectady, N.Y.

POPULAR MECHANICS

CAMERAMEN UNDER FIRE

By Paul Healy

Part 2

IT HAPPENED on the island of New Georgia. Corp. Cyrus P. Collings, attached to a marine raider battalion spearheading an allied offensive, calmly squatted on the bank of a small river and took a picture of a Jap swimming toward the American lines. Then he put his camera back in its case, slung it around his neck, unslung his carbine, and took aim. At the crack of the gun the swimmer disappeared and the marine notched his fourth Jap of the war.

Corp. Collings is one of the dauntless and resourceful combat cameramen who make it possible for Americans to view the progress of the war in intimate closeups every day with their breakfast coffee and after dinner in the neighborhood theater. Equally expert with camera and rifle, these former portrait photographers, newspaper men, shoe clerks, truck drivers, salesmen, etc., are trained to make excellent use of both instruments wherever the fighting is fiercest. As a result of their efforts, and the equally heroic work of the civilian press photographers, every phase of World War II can be told in pictures.

For example, the battle of Tarawa, officially described as the toughest in marine corps history, also was the most photographed because marine combat cameramen were determined not to miss any of it.

The thoroughness of their job depended on men like Tech. Sgt. Norman Hatch and Sgt. Obie Newcomb. With his 35 mm. camera clutched in one hand, Hatch



Pathé News and Twentieth Century-Fox newsreel men (above) are ready to shoot action in European war theater. Below, one marine cameraman protects another from rain during New Britain campaign





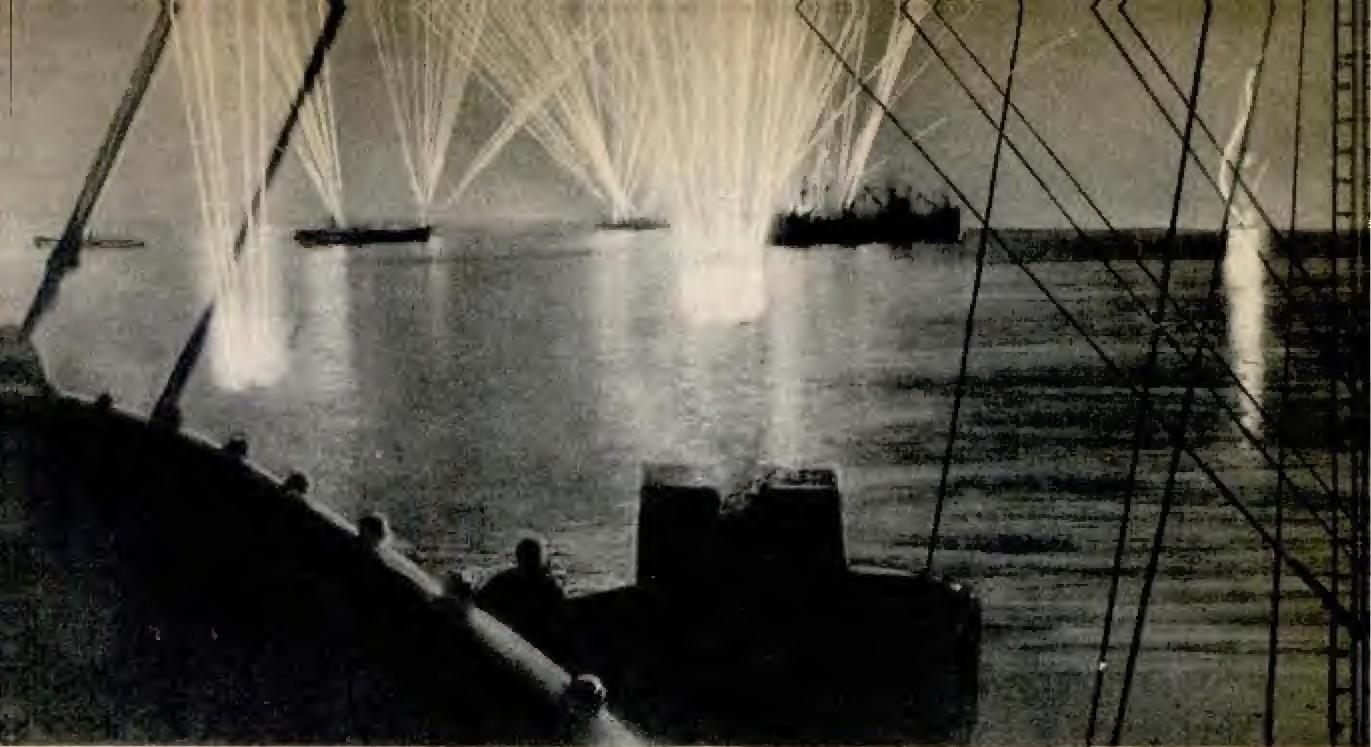
Above, giant aerial camera is checked carefully by skilled repairman in Navy's photo science laboratory before being taken aloft. Below, this striking picture of heavy seas washing the decks of a cruiser was made by a civilian press photographer

rode the top of a landing craft as it raced toward the heavily fortified beaches of Tarawa. Four hundred yards from shore the ship rammed into a coral ridge and Hatch and his buddies were ordered to go over the side. With Jap bullets zipping around him, the sergeant walked those 400 yards holding his camera aloft to keep it dry.

When he reached the beach and dove for cover near the three-foot seawall, he began grinding away. Soon water, sand and flying debris jammed the camera, so he clambered into a foxhole only 20 feet behind the front lines and started reloading. He buried the rest of the film to keep the emulsion from melting, returning later when he needed it. The fact that Hatch was not wounded was considered a minor miracle by those who saw him worming his way forward under the noses of the entrenched Japs.

Newcomb's landing craft was stopped dead by a direct hit, which killed five men, and the survivors plunged over the side. In the excitement, Newcomb forgot his camera but he was needed on the beach anyway so





A trick picture of ack-ack fire—ship in foreground moved closer to camera during three minute exposure

he burrowed into the ground and traded shots with the enemy. Finally he crawled back to the smashed craft, found his camera, and returned to the beach, this time to take pictures of the hectic and violent scene in front of him.

Anxious for more coverage, Newcomb and Hatch obtained permission to accompany a marine flamethrower unit in assaulting a stubborn pillbox. From behind a log they photographed the attack until two men slain by Jap snipers toppled on them, temporarily putting their gear out of commission. Immediately they picked up their rifles and joined in the assault, not returning to fix their cameras until the stronghold had been demolished.

Together with the films made by 13 other marines (two of whom lost their lives), their reels made up a 5,000-foot documentary color movie which one critic said was "war in the least expurgated form Americans are likely to see it." It was so anxiously awaited that it was flown out on the first plane to leave the Gilbert Islands after the battle.

Photographer's mate trains motion picture camera on bombers in sky
U. S. Navy photo

Before going into Tarawa the marine combat photographers said their ambition was to take as realistic pictures as the Red Army cameramen, who have been responsible for some of the world's most dramatic front line photography. One Soviet film, "The People's Avengers," was made by 17 men and one woman who parachuted be-





Above, during a bombardment, Bren gunner and British Army photographer work side by side in North Africa

hind the German lines into the forest hide-outs of Russia's famous guerrilla brigades and fought with them for months, returning with a complete pictorial account of the life of the Partisans. Two of the cameramen were killed trying to make their way back to the Russian lines.



Above, photographing Nazi bombers with "Big Bertha." Left, sighting attacking planes from RAF station, then aiming camera to see if they were hit

Soldier-photographers, however, run less risks than the untrained civilian war photographers, who have no guns with which to defend themselves. Such men as Bert Brandt, of Acme, and Bede Irvin of the Associated Press, who used to photograph baseball games, chorus girls, speechmaking officials, fires, etc., face new and more hazardous problems in covering a battle. Irvin, struck by a bomb fragment, died camera-in-hand while doing close-ups of American infantry moving forward in the wake of a bomb barrage near St. Lo on the Normandy front. He had heard a shouted warning to duck but had hesitated a split second to pick up his camera before diving for a nearby ditch.

Brandt was one of the first cameramen to hit the Normandy beaches. Taking no chance with couriers, he then made three hitch-hiking boat transfers in the rough channel before getting his negatives back to England. His invasion pictures were the first to reach the United States and he would have had a scoop except for the roto picture pool, a noncompetitive wartime setup in which everyone is entitled to pictures made by everyone else, military or civilian.

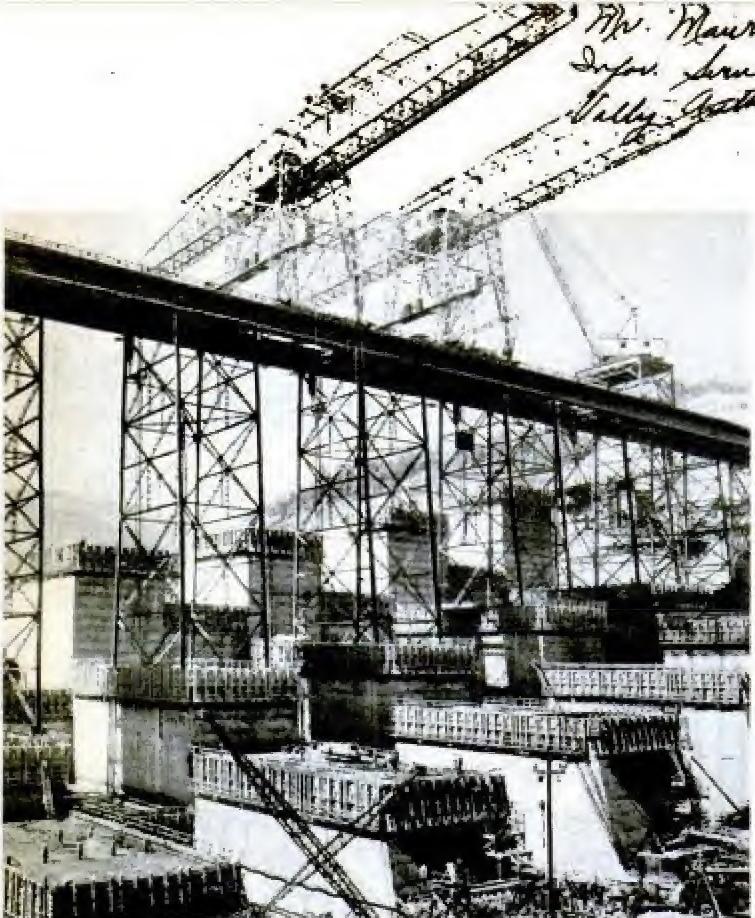
Sometimes the war photographer has to develop his own films at the front. If he has nothing else in which to mix his developing solutions, he uses his steel helmet tightly covered with his raincoat to keep out the light. Sometimes he improvises entire laboratories. With their regular equipment gone, a group of marine corps photographers in the Pacific theater fashioned a makeshift darkroom. The sink was an old fuel tank from an airplane wing. The reflector on the flash equipment once had been the headlight of a steamroller. A mainspring from the bolt of a damaged Springfield rifle was broken up to function as a

(Continued to page 152)



Navy man (above) spies on activities at Jap base with a K-20 aerial camera. Below, cameraman accompanies marines at Bougainville
U. S. Marine Corps photo





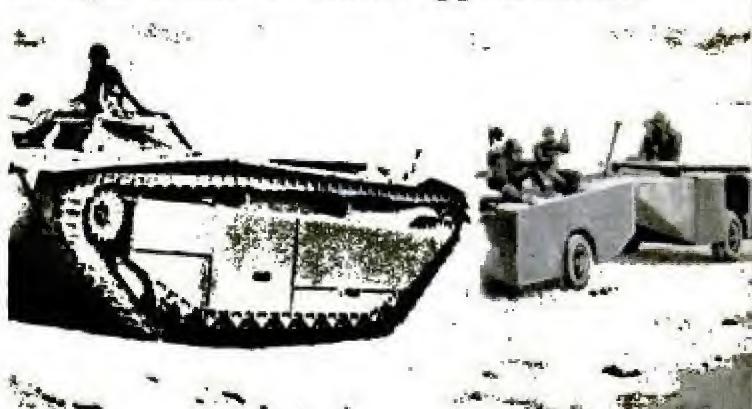
Mr. Maurice Dent, *Photo*
Info. Service Staff, Tennessee C-433
Tennessee Valley Authority, Knoxville, Tenn.
'Skyscraper' Crane at Dam
Lifts 23,000-Pound Load

Towering above a steel construction trestle at Fontana Dam, Tennessee Valley project, are twin hammerhead cranes which operate on rails. These giant cranes are more than 400 feet above foundation rock. Each crane lifts a 23,000-pound bucket load of concrete from a flatcar and transports it to any position along the deck of the trestle. The 300-foot-long trusses are supported on gantry frames, and permit unobstructed movement of suspended loads for 150 feet either way from the centerline of the trestle. An electrical hoist installation permits the handling of great loads swiftly and smoothly. A full load is lowered at the rate of 375 feet per minute, and an empty bucket is returned at a speed of 750 feet per minute.

Twin hammerhead cranes high above trestle at Fontana Dam operate on rails and lift 11½ tons of concrete

"Amphib" Tractor Tows Watertight Trailer to Rush Supplies Ashore

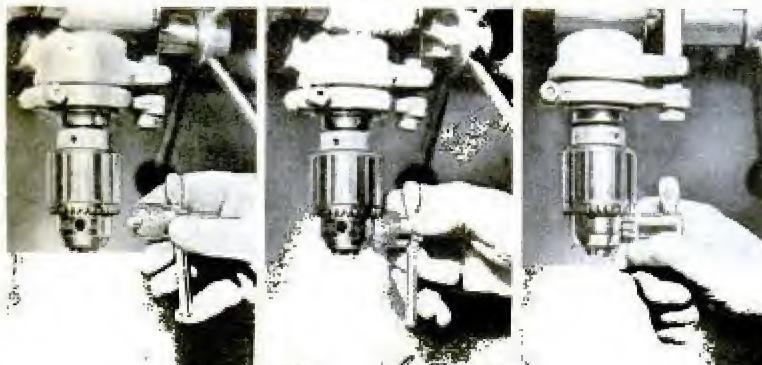
Beachhead operations are speeded up with an amphibious cargo trailer with a capacity of 220 cubic feet. The watertight trailer is towed by an amphibious tractor right up on the beach during combat. In tests conducted by the Marines at Camp Lejeune, N. C., one tractor towed several trailers. Aside from insuring faster delivery of vital supplies, the amphibious trailers land materials in better condition. These trailers eliminate the need for waterproof packaging of some military items.



O 457

O 300

Safety Guard on Chuck Key Prevents Accidents to Lathe Workers



*Safety squatbar
3229 W. 6th St.
Portland, Oregon*

To reduce accidents among machine tool operators, a safety device called the "Kee-Jector" can be fitted as a guard on the chuck key of any size drill or lathe so that it ejects the key the moment the chuck is tightened. The fool-proof guard makes it impossible to leave a chuck key engaged in a tool chuck when power is turned on. Failure to remove the key has caused a large number of head and hand injuries to workers.

Mr. John Orr Young
14 W. 49th St.
N.Y., N.Y.

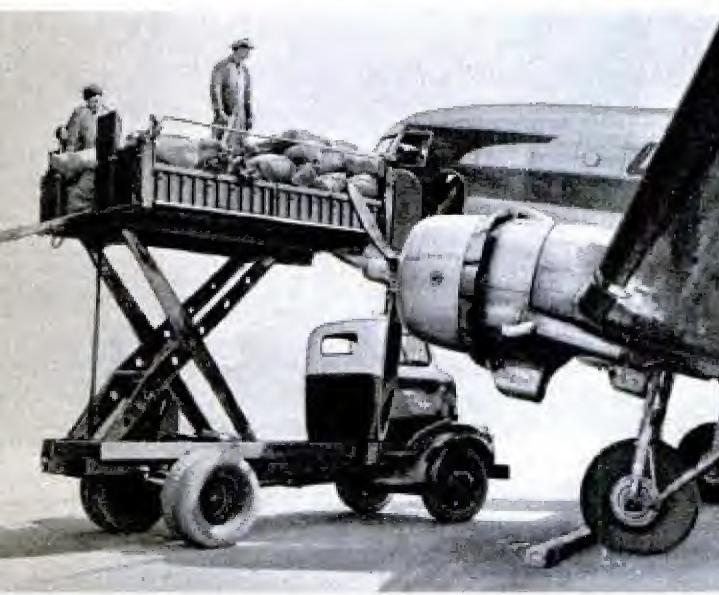
Electric Heat Vulcanizes Tire Without Removing Tube

With an electronic device that applies "internal heat," tires are vulcanized in 10 minutes in combat zones. The process does not harm the inner tube, thus making it unnecessary to remove a tire from the rim. This vulcanizing unit, developed for the Transportation Corps, weighs only 500 pounds and replaces equipment weighing tons and requiring hours to operate. It consists of a press ram with an electrode coupled to a high-frequency generator and a press frame. Ram and frame are fitted with filler bags that adjust themselves under pressure to varied tire contours, eliminating the use of molds. After the war this process may be used for recapping to extend the life of tires to 100,000 miles. It may also be adapted to the production of new tires.



0423

Scissors Action Raises Truck Body as High as Cargo Plane's Doors

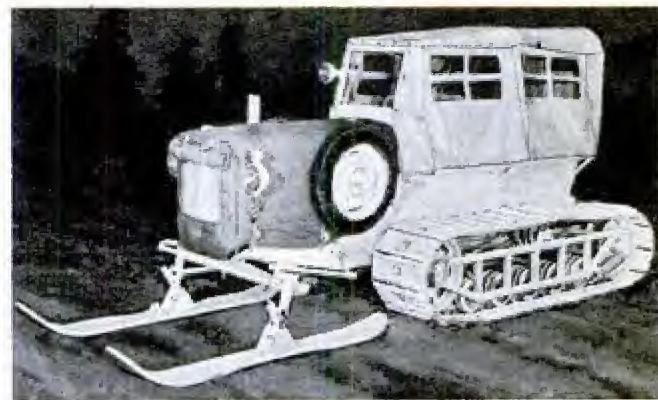


30 Nov 42

To facilitate the transferring of material between trucks and the high fuselages of cargo planes, the Air Force employs a unit built by the Heil Company, Milwaukee, Wis., which gives a standard army truck a high lift body elevated by scissors action. The mechanism consists of two hydraulic cylinders that boost the body straight up to 10 feet or any intermediate height. When the truck is backed up to the plane, the body is raised until the floor is exactly the same height as the cargo door and a specially designed tailgate is lowered for loading or unloading. Two flood lights which fit on the rear corners of the high lift body make night loading easy. The unit is built to withstand temperatures from 50 degrees below zero to 160 above.

Snow Tractor Has Sled Runners on Front for Rescue Work in Arctic

With skids on the front and treads on the sides, an Army snow tractor speeds over Arctic regions at 40 miles an hour. This light-weight vehicle, known officially as the M-7, is coupled with a snow trailer and used primarily to rescue downed fliers. It can also be used as a cargo carrier. Engine and body are covered with heavily insulated material for operation in sub-zero weather. The tractor has a four-cylinder gasoline engine with six forward and two reverse speeds.



0410

A WARBIRD LAYS an EGG



Official U. S. Army photos

The photographs on these pages are the first released by the Army in this country of a 2,000-pound bomb demonstration—covering all steps from careful preparation and loading to the actual "hit." Tests are conducted by experts at Army Ordnance Department Proving Ground in Aberdeen, Md., scene of photos

Attaching the tail fins to a bomb (above) is a last-minute job prior to loading, for a bent fin may mean a "miss." The fins guide the bombs on their downward flight, and because they are made of light metal must be handled with extreme care. Note red flag across bomb warning other workmen to keep safe distance

Below, hauling a 2,000-pound demolition bomb on three-wheeled pneumatic-tired carrier into position under bomb bay of plane. Soldier in the rear carries a pistol to enforce rigid safety rules during the process



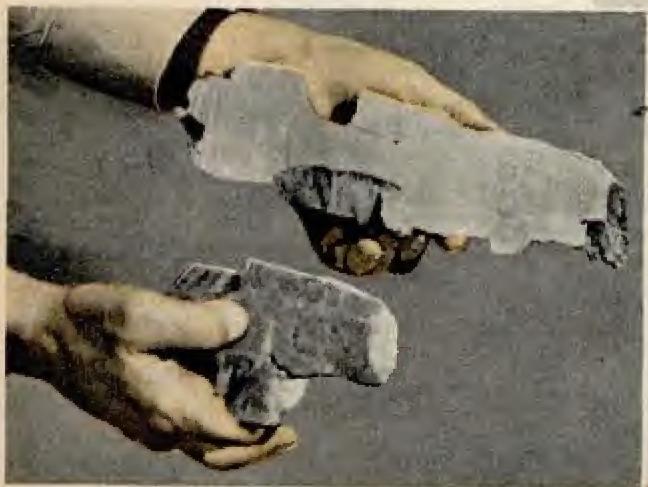
Left, electric winch inside plane lifts giant bomb through bay into its "riding" position. Flying personnel and bombardment aircraft are supplied by Air Corps for tests

Mr. G. H. Moore
1362 N. Dearborn St.
Chicago 10, Ill.

O 353



One-ton demolition bomb is shown (above) an instant after its release from two-engined plane. Below, parts of the same bomb after explosion—two jagged fragments of metal. These flying fragments cause only secondary damage; the effect depends on enormous blast



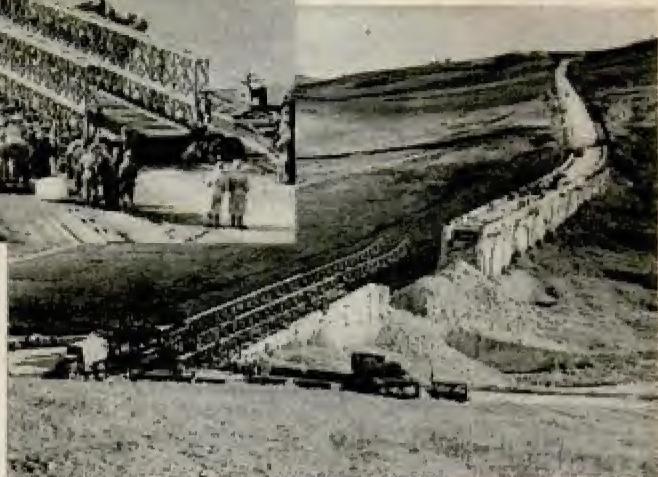
Flame, smoke and dirt billow to height of 2,000 feet when bomb explodes. This photograph was taken with telescopic lens one mile away. Left, crater dug out by bomb; officer holds fragment

Mr. D. C. Bailey of the British Ministry of Supply, London, England. 0379.

Jig-Saw Span Joined by Pins Is Assembled Easily



Left, a Bailey span thrown over a river in Great Britain. Below, a Bailey bridge being erected across a gap in a road bridge in Italy



Described as the "most remarkable bridge in military history," the British-designed Bailey, which can be assembled quickly and easily, was a boon to the allies in their march through Normandy. The bridge can cross any gap up to 240 feet without pontoons and with pontoons it can span much wider gaps. In its lightest form the bridge can carry 20 tons, but its construction may be doubled or trebled to carry the heaviest tanks. Known as the "panel bridge," to Americans, it fits together like a gigantic jig-saw puzzle. There are no nuts or bolts and only one steel pin is needed for each joint. Sections are 10 feet long and are

composed of 17 parts. Nine other parts are used to make the foundation. Six men can handle the heaviest parts with ease. The bridge is built first on rollers on the bank of a gap and then pushed over by a crew with mechanical aid. With this span, sappers in Italy bridged a 300-foot gap across the Trigno river in 36 hours.

O 4/14 Power Unit to Move Wing Flaps Weighs Only 8 Pounds



Basic Products Co.
11610 Euclid Ave.
Cleveland 6, Ohio

Wing flaps, landing gear and other parts of large aircraft can be operated with a pint-size hydroelectric power unit that weighs only eight pounds. The space-saving unit includes motor, pump, control valves and reservoir. It is installed at the location of the hydraulic cylinder operating the airplane parts, thus eliminating long lines of tubing.

O 4/93 Gauge Measures Porosity As Air Is Evacuated

By measuring the rate of flow of air or gases forced out of a vacuum chamber, a small, portable apparatus determines the relative porosities of materials. The apparatus consists of a vacuum chamber placed in contact with the material to be tested, a power-driven fan for evacuating air from the chamber, and a pressure gauge to measure the degree of partial vacuum in the chamber.

POPULAR MECHANICS

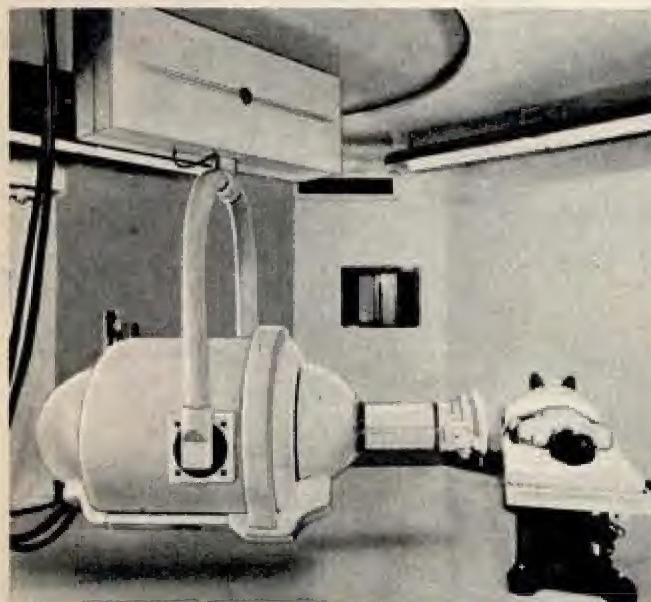
B. F. Goodrich Co.
Akron, Ohio

P.O. Box 312
Canoga Park, Calif.

7945

Undersea "Tractor-Tank Has Sealed Compartment

Treasure hunts beneath the sea may reach new depths with an electrically driven "tractor-tank" designed to carry a crew of two in a sealed chamber. Caterpillar treads would carry the tank along the sea bottom while cranes, mounted at the corners and on top, pick up the treasure. The tractor-tank could be lowered by cable from a salvage ship to depths of 2,000 feet, according to its inventors, Charles G. Warren and Lt. Harry E. Rieseberg, who have constructed a model. They believe the crew could stay at extreme depths for 10 or 12 hours at a time. Oxygen would be carried in tanks, eliminating the usual air lines.



O-4205

X-Ray Gun Fights Cancer With Therapy Rays

Regarded as a siege gun in the fight against cancer and other malignant diseases, a giant, million-volt X-ray machine at the Walter Reed General Hospital in Washington, D. C., can "shoot" therapeutic radiation equal to 90 million dollars worth of radium, or 12 times that of the entire supply in the United States. Pushbutton control of powerful motors lowers the unit through a concrete opening in the ceiling of the hospital's specially constructed radiation therapy section, where it can be directed at the patient. The unit was modeled after industrial units in war plants and shipyards, where they scan metal castings for flaws.

made by General Electric Co.
Schenectady, N.Y.

0419

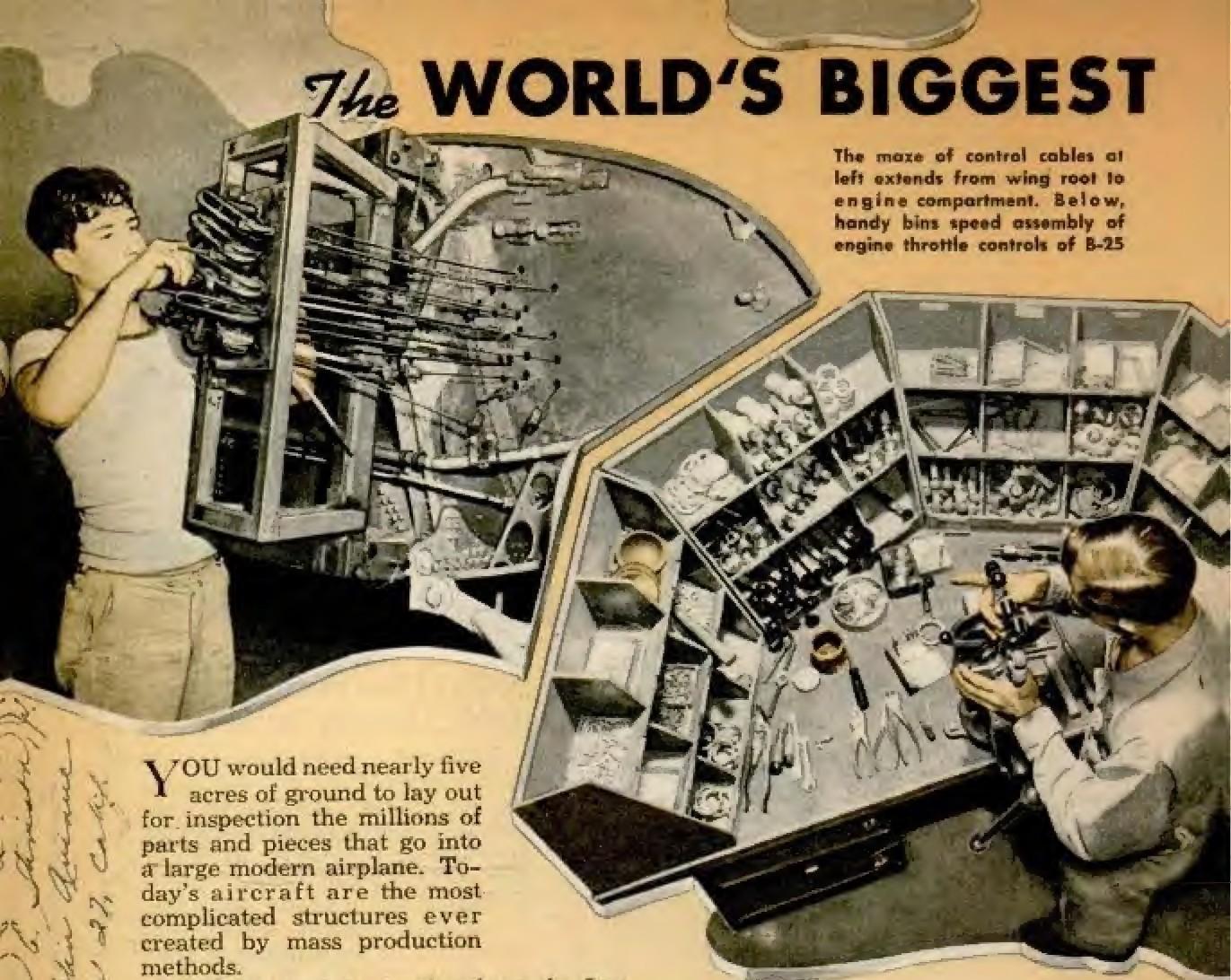
Dogs Hunt Mines Defying Detectors Used by Sappers

In Normandy, dogs trained by the British helped locate the all-wooden "shoe mine" devised by the Nazis to resist mine-detecting apparatus. After the dogs locate a mine, the spot is marked so sappers can come along and dig it up. It was found that a "K-9" corps of 20 dogs can clear a lane 16 yards wide at the rate of 400 yards an hour.



The WORLD'S BIGGEST

The maze of control cables at left extends from wing root to engine compartment. Below, handy bins speed assembly of engine throttle controls of B-25

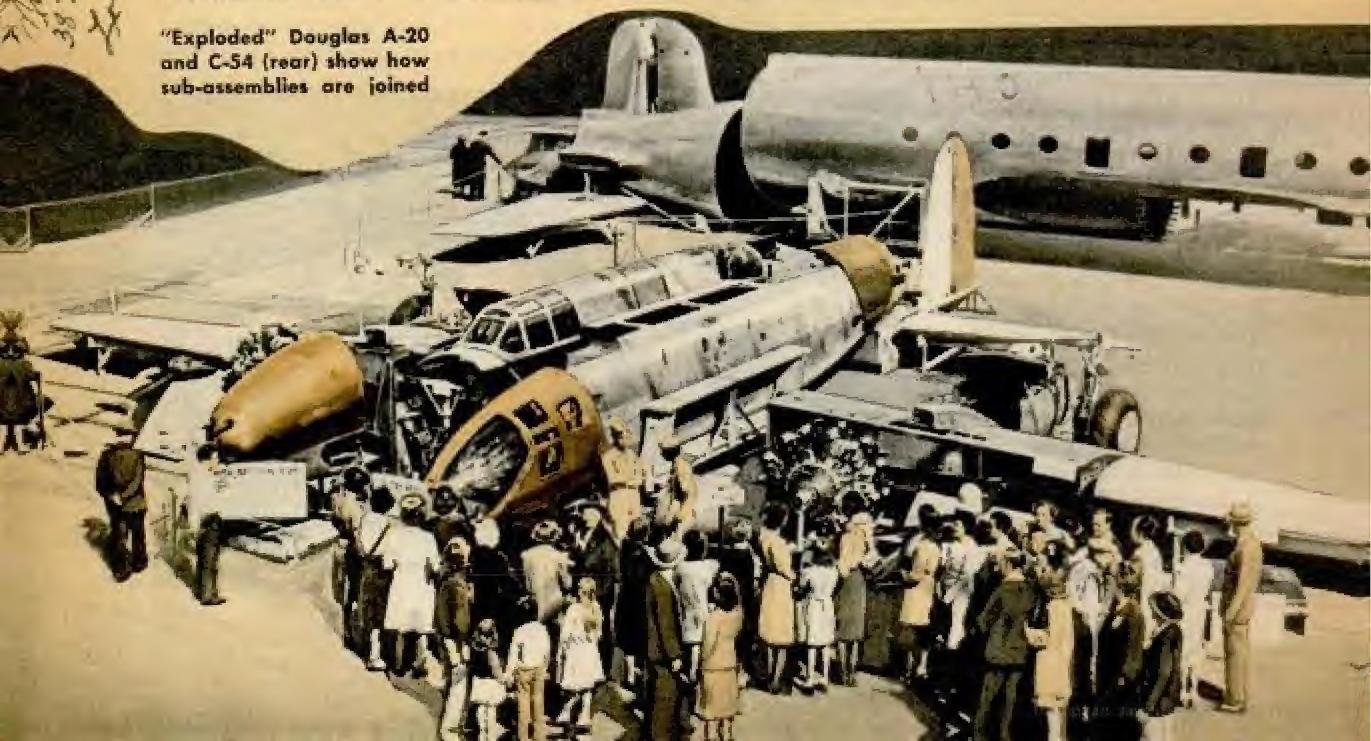


YOU would need nearly five acres of ground to lay out for inspection the millions of parts and pieces that go into a large modern airplane. Today's aircraft are the most complicated structures ever created by mass production methods.

Aside from our largest bombers, the first of the big ships produced on assembly line basis is the Douglas "Skymaster," the military version of which is called the C-54. This plane can carry a payload of 20,000 pounds 1,500 miles nonstop. It has flown from San Francisco to Brisbane, Australia,

in 39 hours, the time it takes a streamline train to travel from Chicago to Los Angeles. The plane has a wing span of 117 feet, take-off power of 5,400 horsepower, a top speed of 285 miles per hour, and a gross loaded weight of 32½ tons.

"Exploded" Douglas A-20 and C-54 (rear) show how sub-assemblies are joined



JIG-SAW PUZZLE

O 371



Top, phantom view of a "Mitchell." Below, midge-
sts crawl inside to as-
semble an aircraft wing

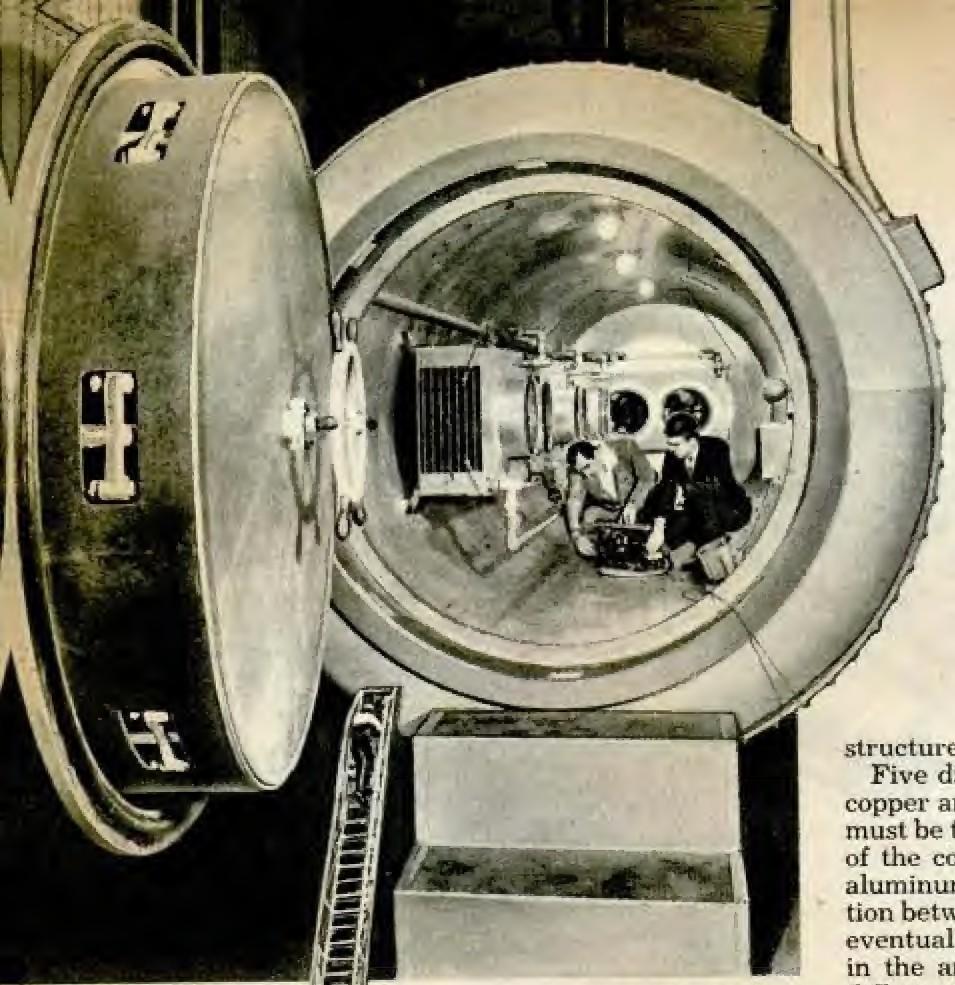
As an air liner after the war it will transport 44 passengers and a crew of five in addition to mail and express. Its 55-foot cabin is of box car proportions.

Today as a military transport it is carrying cargo to all parts of the world. It can throttle down to 105 miles per hour for discharging paratroopers, but its principal job is delivering parts to bomber and fighter bases. The C-54's carry plasma and medical supplies as well, or may be loaded with food and ammunition for isolated posts. On return trips to the United States the planes carry as many as 54 wounded men, or they bring back tungsten, diamonds, tin, mica, or silk. Skymasters have carried President Roosevelt and Prime Minister Churchill on trans-oceanic flights.

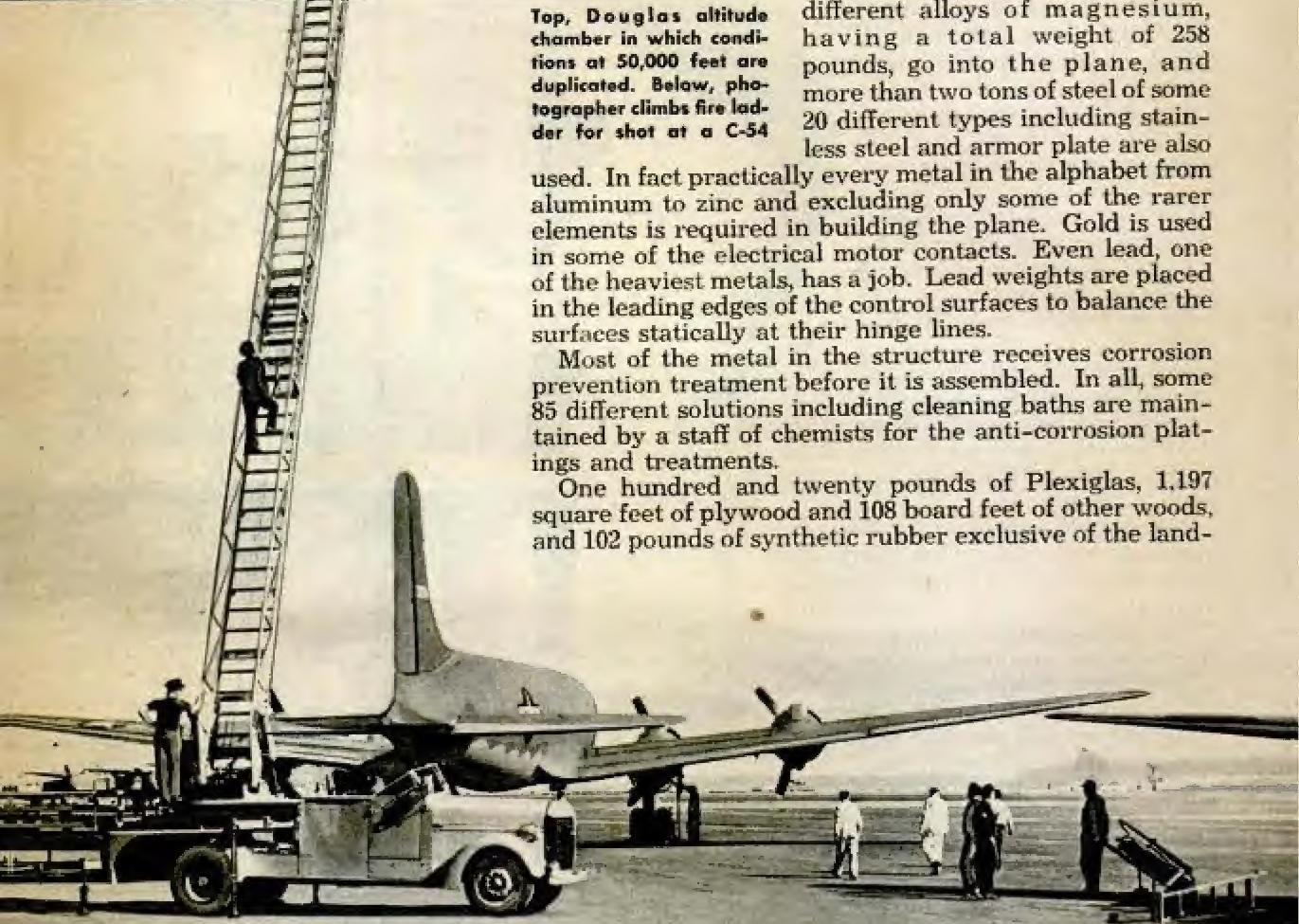
The simple airplanes of the past had little more than ribs, spars, and air in their wings and fuselages. But no matter where you cross-section a C-54 you encounter an intricate maze of structural members, control gear, electric wiring, hydraulic piping, and miscellaneous equipment. Assembling the myriad parts is a real jigsaw puzzle for the engineers.

Eight tons of aluminum go into each C-54, but this tonnage is not simply aluminum metal. It consists





Top, Douglas altitude chamber in which conditions at 50,000 feet are duplicated. Below, photographer climbs fire ladder for shot at a C-54



of 30 different special alloys of aluminum. Some is in sheet form and must be handled more carefully than precious jewels, some is in the form of castings, some in extruded shapes. A scratch only $7/10,000$ ths of an inch deep on a thin sheet of aluminum leads to rejection of the sheet in the factory, for such a tiny surface scratch would ultimately lower the sheet's resistance to fatigue. One special alloy is used for the more than one million lightweight rivets which fasten the structure together.

Five different kinds of alloys of copper are used in the C-54. Care must be taken to avoid placing any of the copper in contact with the aluminum alloys; electrolytic action between the two metals would eventually destroy the aluminum in the area of this contact. Five different alloys of magnesium, having a total weight of 258 pounds, go into the plane, and more than two tons of steel of some 20 different types including stainless steel and armor plate are also

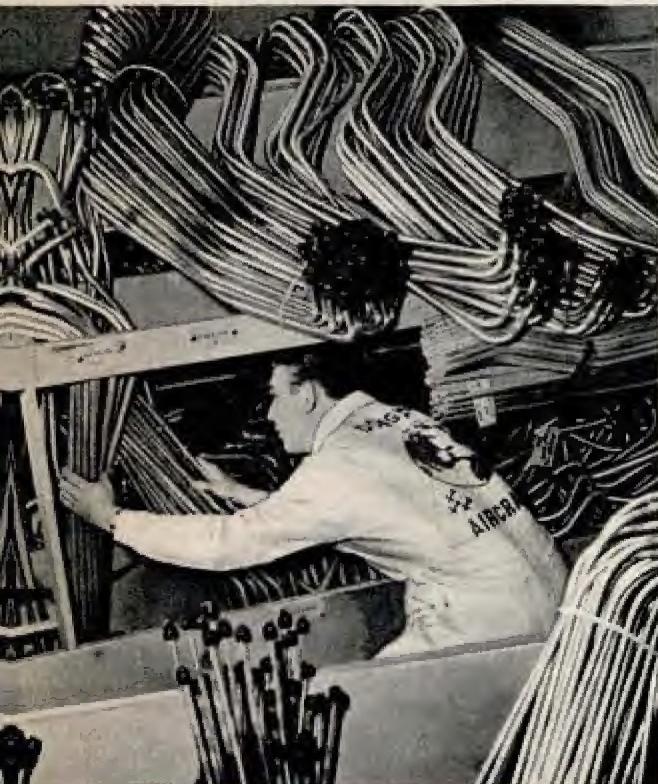
used. In fact practically every metal in the alphabet from aluminum to zinc and excluding only some of the rarer elements is required in building the plane. Gold is used in some of the electrical motor contacts. Even lead, one of the heaviest metals, has a job. Lead weights are placed in the leading edges of the control surfaces to balance the surfaces statically at their hinge lines.

Most of the metal in the structure receives corrosion prevention treatment before it is assembled. In all, some 85 different solutions including cleaning baths are maintained by a staff of chemists for the anti-corrosion platings and treatments.

One hundred and twenty pounds of Plexiglas, 1,197 square feet of plywood and 108 board feet of other woods, and 102 pounds of synthetic rubber exclusive of the land-

ing tires are among the materials used in the C-54. The landing tires, incidentally, carry an appreciable weight of dead air just to keep them inflated. On such a large airplane as the B-19, larger than the C-54, the main landing wheels weigh 58 pounds more after the tires are inflated than they do before the tires are pumped up.

The retractable landing gear of a C-54 is probably more complicated than an entire airplane used to be. The two main landing units have double wheels, and the nose wheel is steerable from the cockpit. All three units have shock absorbers. The wheels are lowered and are retracted by a hydraulic system that also closes the wheel well doors when the wheels retract, completely eliminating drag. The plane's high-pressure hydraulic system is operated by



four engine-driven pumps. In addition to moving the landing gear it also operates the wheel brakes, the engine cowling flaps, and the wing flaps.

A separate complication is heating and ventilating. For the comfort of its crew a medium sized military airplane may carry gasoline-fired heaters powerful enough to warm half a dozen seven room houses. Some aircraft have hot air heaters inside their wings to prevent the formation of ice along the leading edges. Aside

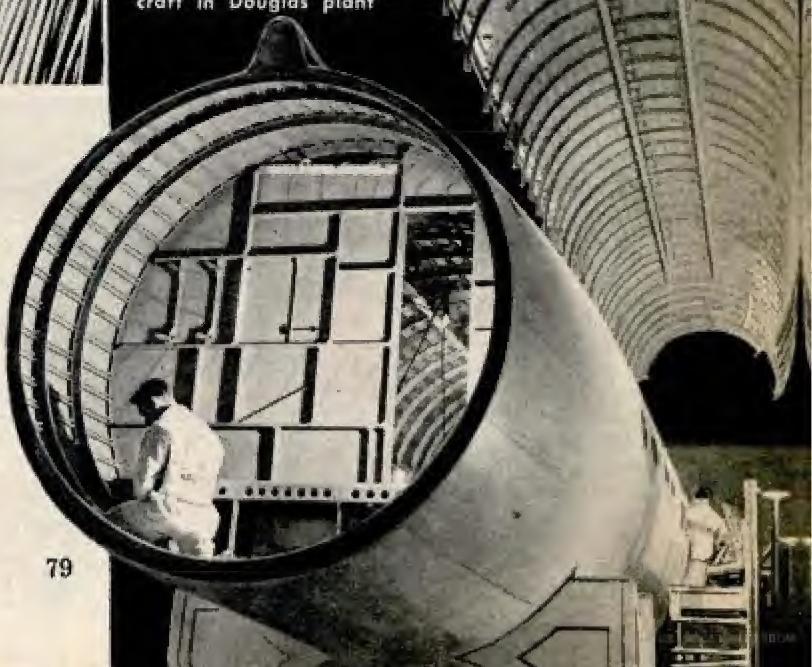
(Continued to page 154)



Sand blast cleans engine fittings before treatment to prevent rusting

Left, hydraulic oil lines and fittings, pre-shaped and ready for assembly

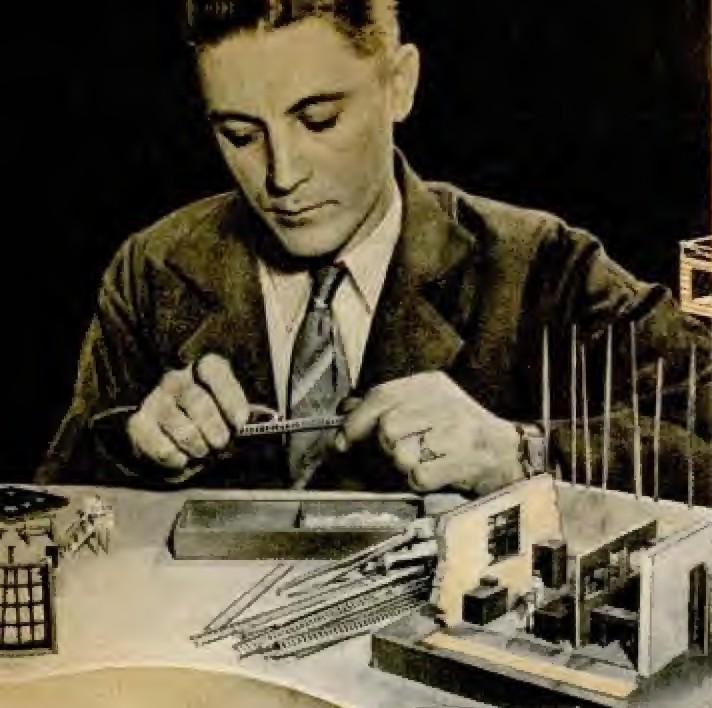
Below, assembling giant fuselages of C-54 aircraft in Douglas plant



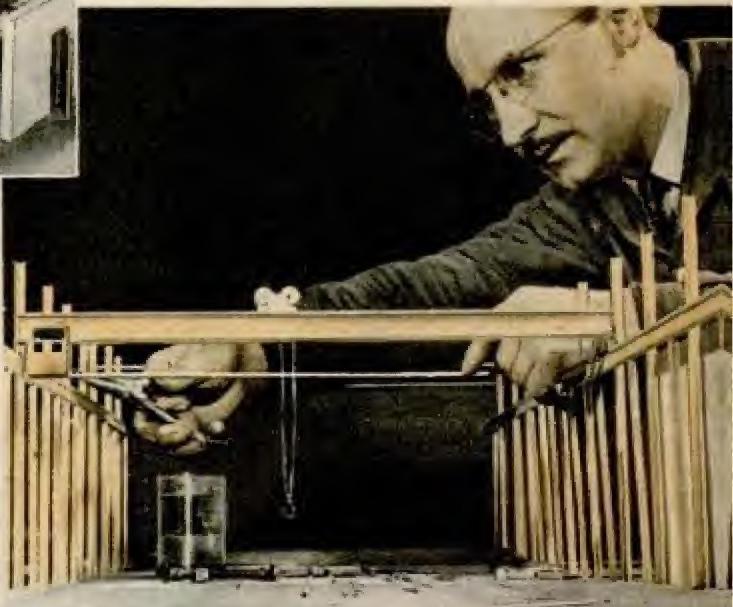
0430

FACTORIES from "DOLLHOUSES"

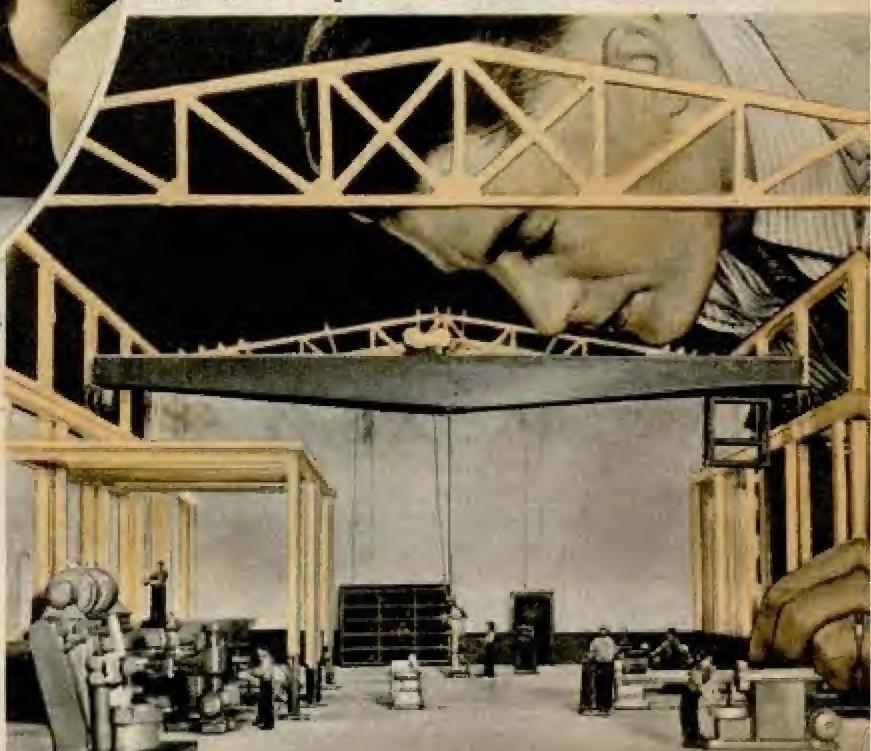
Factory "doll houses" help layout engineers plan postwar plants with a three-dimensional preview. Left, preparing conveyor track for "doll house"



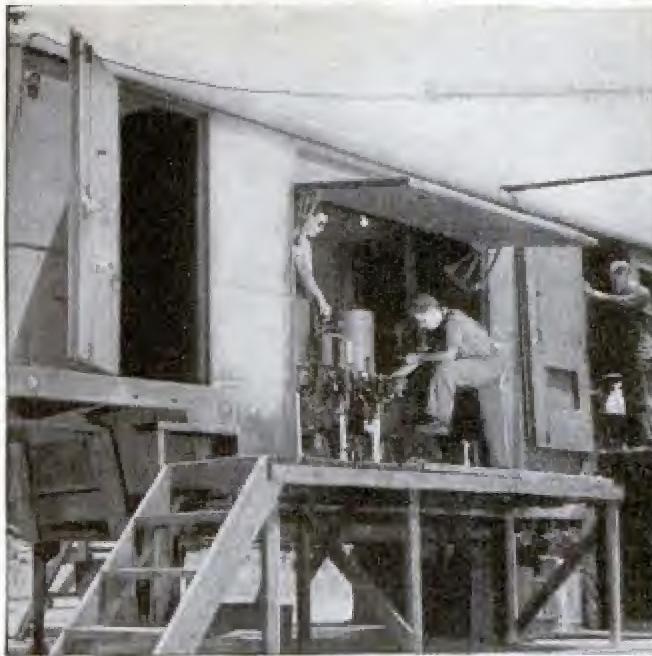
Westinghouse photo
Co.
C. E. M. Pittsburgh Pa.
Miniature lathe (above) is so small, engineer holds a tiny piece of wood to show where part to be machined would be placed. Right, preview of how machines can be placed for greatest efficiency is provided by model



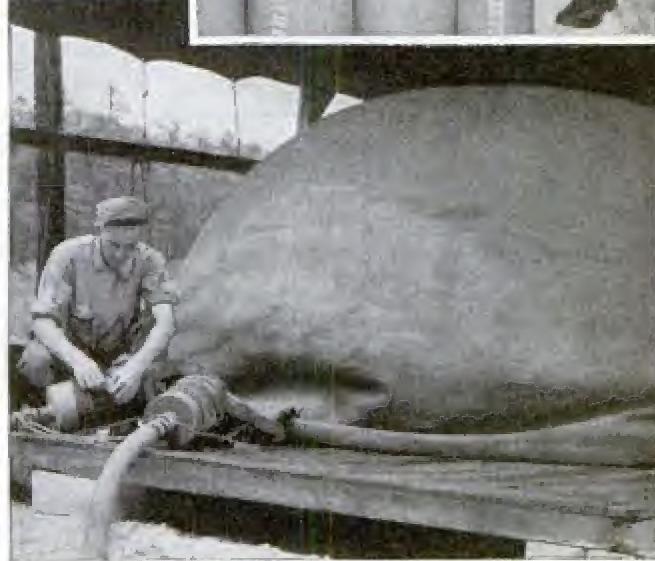
Fastening a cross-beam of "doll house" factory under construction in Westinghouse workshop. Completed model will be filled with figures of men and machines built to scale



Air Force Generates Oxygen in Portable Units



Giant portable generator units are carried to overseas bases to provide the oxygen necessary to flyers who climb higher than 10,000 feet. Each of the Air Force's units, which weigh about 36,000 pounds complete, can produce up to 15,000 cubic feet of oxygen every 24 hours. Powered by 110 horsepower Hercules gasoline engines, they are hauled by a 7½ ton tractor and manned by a crew of 16. It takes only five hours to set them up for operation or dismantle them for moving. Thirteen hours are required to cool the plant down for operation and the same time is necessary for its warming up process after operation. Thus the unit is operated continuously in one location, where conditions will permit, for two or three weeks or until the chemicals used as drying and purifying agents for the air



have been exhausted. The generation of oxygen is accomplished by the fractional distillation of air process.

0237

Plant That Nourishes Itself

Chlorellin, one of the newer germ-discouraging compounds in the penicillin family, is the first of the group to be found in a green plant able to manufacture its own food out of natural raw materials. The other compounds are made by molds, soil bacteria and other plants that have to be supplied with ready-made foods in the form of glucose solutions or the like. If chlorellin is found practicable for medical purposes, all its producing plant will need

is water, a few assorted mineral salts, and a supply of carbon dioxide bubbled through the tanks in which they grow. Chlorellin, which is extracted from the chlorella plant, a common one-celled fresh water alga, checks the growth of such organisms as streptococcus and staphylococcus. In contrast to penicillin, which merely weakens germs until the white corpuscles can finish them off, however, it is believed that chlorellin may even kill bacteria.

*U. S. A. F. Technical Center, Office of the Chief of Ordnance,
Ordnance Division, Oklahoma, 2011*

Signal Corps
Bureau of Public Relations
War Dept., Washington, D. C.

SIXTY-YARD FLASH



Mass demonstration of flamethrowers at a Chemical Warfare depot.
Below, flamethrower on Bougainville routs Japs who defied bazooka



By Roderick M. Grant

IT ISN'T PRETTY, fighting with flames. But nothing in war is pretty, least of all the bark of a Jap machine gun from a timbered pillbox up ahead and the spatter of bullets against the log that shields you from immediate death in a rain-filled hole in the jungle.

The Marines had been pinned down long enough. It was time to clean out that nest.

Two riflemen crept forward to right and left, keeping the narrow slit in the Jap pillbox covered. Between them the man with three tanks on his back and the "insect sprayer" in hand moved cautiously ahead. Now they had closed the range to 60 yards.

"Start your cooker!" someone shouted. There was a hiss of escaping gas under pressure and a jet of orange shot from the flamethrower. A two-second spurt corrected

Standard Oil Company (New Jersey)
Rm. 1626, 30 Rockefeller Plaza O 370

the aim, then a spurt of several seconds' duration arched through the jungle foliage right into the slot in the dugout. Inside, the jellied gasoline spattered and clung to the walls, flames leaped around the protective maze of timbers, and with a yell four Japs burst out of the pillbox and dropped, dying, at the exit. The rest were



Signal Corps photo

M1-A1 bores a hole through jungle on Munda, where numerous pillboxes were cleaned out. At left is the portable flamethrower

dead inside. The Marines resumed their advance.

The story was repeated at Munda and Bougainville, Tarawa and Kwajalein, Saipan and Guam. It was the same, with different settings, against the Germans in Italy. When the boys are stopped by a particularly tough pillbox that resists even direct shell hits, they call for the G. I. Hotfoot. That's Yankee for the M1-A1 flamethrower.

The "sixty-yard flash" below shows how the glowing jet of thickened gasoline can be aimed at distant target with great accuracy

Photo from Standard Oil Co. of N. J.





Jellied gasoline arches toward target, striking as a mass of flaming goo. In combat the trajectory is flatter

Fire has always been one of the most destructive weapons of man. The Germans introduced the modern flamethrower in 1915. It had a range of only 70 feet and its billowing flames were almost as dangerous to its operator as to the enemy except in a strong, favorable wind. We had nothing much better in 1942. The Chemical Warfare Service put the problem up to the Standard Oil Development company, already working on a gelled-gasoline incendiary bomb.

Thickened gasoline turned out to be the

answer. The remaining problem was to adapt the existing flamethrower to the new fuel. The result is the M1-A1, which throws a cohesive rod of fire with such accuracy that it can be directed into a two-inch bunker slit 60 yards away. The jet, traveling at nearly two miles a minute, does not billow out but strikes its target as a solid, glowing stream, then spatters and sticks to any object, blazing with terrific heat that destroys guns and all life within the pillbox. In the jungle a quick burst bores a clean hole through thick foliage,

A light tank of the U. S. Marine Corps turns its flamethrower on Japanese holding out in a cave on Saipan

U. S. Marine Corps photo





Flame jet is aimed through narrow slit of pillbox in practice

clearing a view of the target without burning away all cover in front of the attackers. Because the sticky jelly splashes around corners, the flamethrower can maneuver out of direct range of the bunker defenders and bounce gobs of fire off the side of the gun port.

The flamethrower consists of two steel fuel tanks, and a cylinder containing compressed air or nitrogen, weighing 60 pounds; and the flame gun weighing eight pounds, to which is attached a small cylinder containing hydrogen. To start his "cooker" the operator opens valves releasing the chemicals, presses a button to vent hydrogen gas from the brass nozzle, and a spark plug ignites the hydrogen which acts as a pilot light for the gel-gasoline when it is turned loose by squeezing a trigger valve.

The formula for the jelly is one

(Continued to page 150)



Gel-gas bomb fires Jap-type building; below, laying smoke



0442

"Iron Horses" Ferried to France Haul Supplies



Normandy Beachhead

Many strange sights moved across the English channel on the backs of landing craft in the weeks following D-Day but

probably none looked more unusual than Diesel railroad engines. The "iron horse" was put to work hauling supplies.

0452

Superpowered P-63 Kingcobra Outflies Its Parent P-39

Boasting a two-stage, 1,500-horsepower Allison engine, the P-63 Kingcobra can fly higher, faster and farther than its predecessor, the P-39 Airacobra. The P-63 has an official combat radius 50 percent greater than that of the P-39, a service ceiling of 35,000 feet, and close to 400-miles-an-hour speed. The power plant, which develops 300 more horsepower than the Airacobra's,

gives higher compression through the use of a fuel supercharger geared at one speed for medium altitudes and at a higher speed for high altitude flying. Other improvements are the low-drag, laminar flow wing section designed to produce minimum drag; an automobile-type door, a big air-intake scoop beside the pilot's seat and exhaust outlets on the side of the fuselage.

Bell Aircraft Corp.
2050 Cleveland Ave.
Buffalo 2-7171

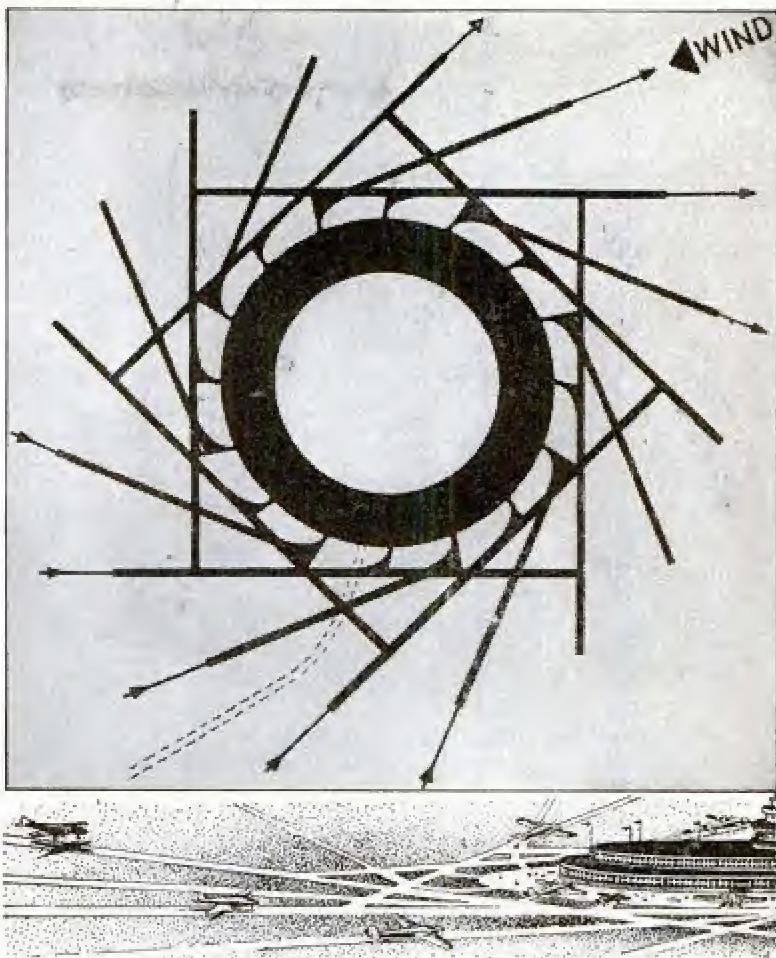


Profiles of Bell's two fighters—the P-63 Kingcobra (foreground) and the P-39 Airacobra—are compared in flight.

Tangent-Runway Airport Would Increase Traffic

For greater efficiency, economy and safety, American Airlines officials suggest a tangent-runway airport built around a central terminal. They point out that such an airport could have runways arranged to permit simultaneous multiple take-offs away from the terminal on converging runways coincident with simultaneous multiple landings toward the terminal on converging runways. The novel layout would be notable for expandability by logical stages, reduction of taxi distance and safety during multiple operation, they maintain. Under the plan proposed, when five adjacent runways are used simultaneously, each has a usable length of 6,000 feet but alternate runways have an actual length of 10,400 feet.

Planes land toward terminal while other flights take off away from it toward the opposite side of the area



Delicate Balance of B-29 'Prop' Upset by a Handkerchief

When propellers for the B-29 Superfortress are adjusted to perfect balance,

they will turn when a half-ounce handkerchief is placed on the blade, according to tests made at the Bell Bomber plant, near Marietta, Ga. Upon arrival at the plant, propeller blades are assembled and placed at different angles in a testing machine which determines which blade is heavy and which light. Particles of lead wool are added at the hub-point of the lighter blade until perfect balance is attained. A thin coating of paint along a blade sometimes is sufficient. The tests are conducted within two large pits closed off to prevent air-borne particles from striking the blades.

*Bell Ringed
cage.*



In 1942 the average life span of the American people reached a high record of 64.82 years, statisticians of the Metropolitan Life Insurance company report.

0384

Captured Nazi Truck Is Mobile A.P.O. For Americans in France



Finding use for equipment captured from the Germans is a characteristic of Yankee ingenuity. In France, American troops put a captured Nazi truck to work by converting it into a portable postoffice. After rigging up a board studded with pigeonholes behind the cab, Americans near Cherbourg sorted mail and distributed it to the soldiers just as if they were in a small town.

0412

Bombsight's Robot Mind Finds Target at Night

Acting as a robot mathematician for bombardiers, the T-1 British bombsight makes possible accurate bombing during night operations and while a plane is being maneuvered at low altitude. The bombsight consists of a computer and a sighting head, which contains an optical telescopic mechanism. As the plane nears the target, the pilot sets the sight in operation and feeds information to the mechanical mind of the bombsight, which computes all variables, such as air speed, altitude, wind direction and speed, and transmits them to the sighting head. The bombardier tells the pilot how to steer the plane. Looking into the telescope, with one eye the bombardier sees the target and with the other he sees two lines of light forming cross hairs. When the cross-hairs appear to be on the target, he releases the bombs. As high as four miles above sea level the T-1 is reliable in giving the correct point in space at which the bomb must be released.

88 made by AC Spark Plug Co.
Plant.

to strike the target, whether the plane is climbing, diving or turning. The bombsight's moving parts are operated by high air pressure and vacuum developed by special pumps connected to the plane's fuel system.

Range of Plane Increased By "Magnetic Tailwind"

By determining accurately the power output of his engines, a bomber pilot can save enough fuel to add 100 miles or more to the range of his ship. This is done with a torquemeter, or "magnetic tailwind," which registers the "twist" of a propeller shaft on a dial. The instrument, developed by Westinghouse, measures the driving force delivered to the propeller by the engine by the amount of twist. This may be only a few thousandths of an inch for a distance of several inches along the shaft. The vital part of the torquemeter is a stationary metal sleeve

and coil assembly which encircles the propeller shaft. Projecting from rings on the shaft are two sets of gearlike teeth whose faces are a few thousandths of an inch apart. As the propeller shaft twists under the load, the distance between the teeth changes. Invisible magnetic "fingers" extending across the gap between the metal sleeve and the shaft detect this change and report it electrically to the pilot's dial.



Torquemeter registers slightest twist of the shaft

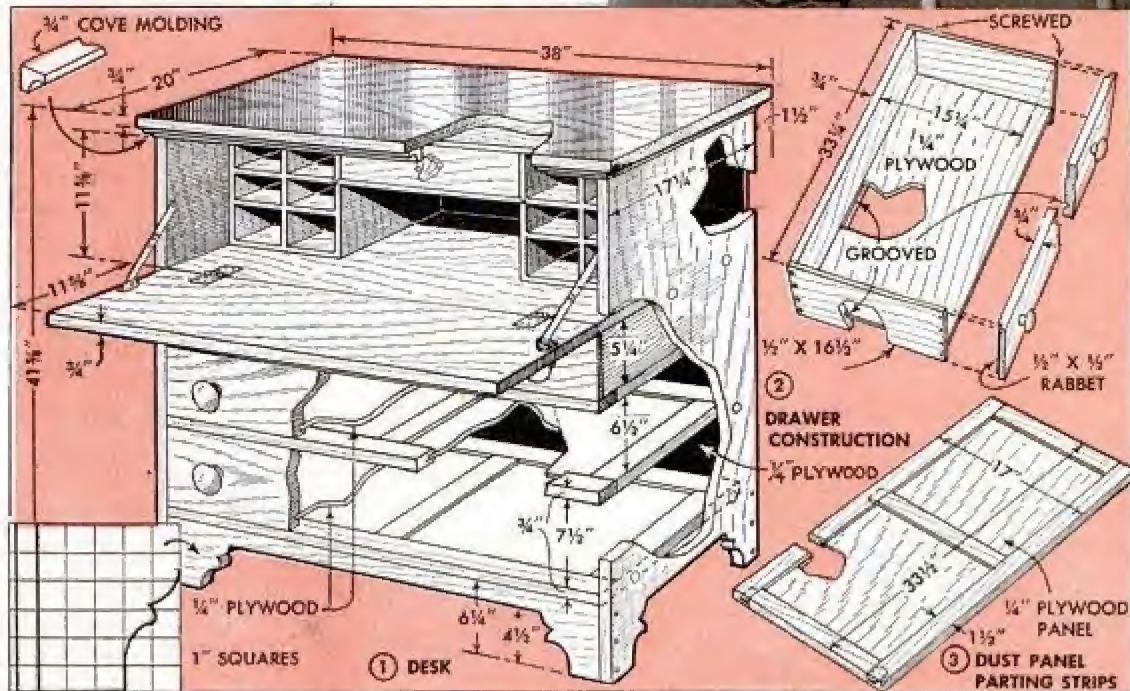


DESK and SHELVES for the boy's room

By Norbert Engels

THIS combination desk, clothes chest and shelf has a drop front which serves as a writing table and hides a pigeon-hole unit for storing pencils, ink, paste bottles, crayons and other items of stationery, and even a secret compartment for personal papers and letters. The shelf unit will hold textbooks, paper and other material too bulky for the smaller desk compartments. Moreover, though the shelf forms a pleasing counterpart to the desk, it is entirely separate and can be removed and hung on a wall in another part of the room if desired.

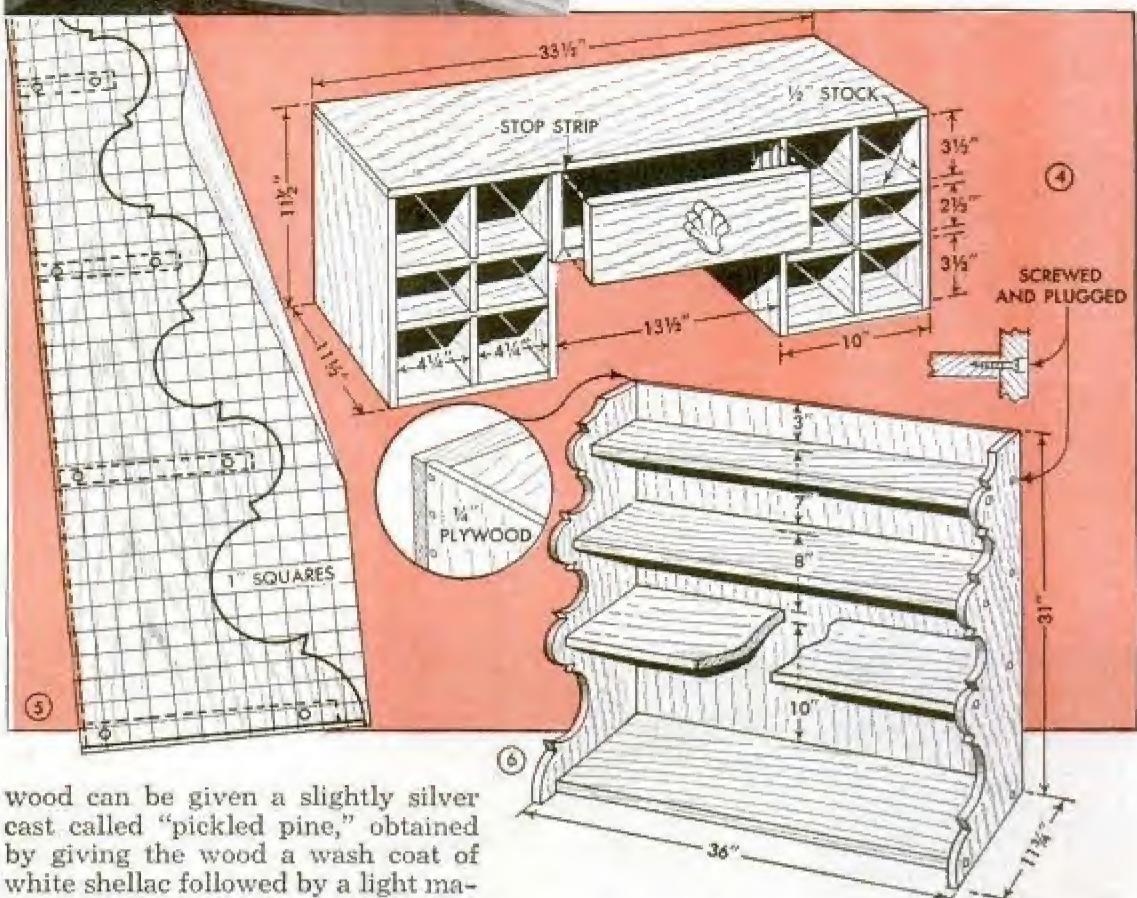
Ordinary white pine will do for both desk and shelf units if they are to be painted, but knotty pine left in natural finish looks especially attractive in a boy's room. Or, the





board, preferably the former if available. Next, make the dust panels between the drawers as shown in Fig. 3. The ends serve as drawer guides and the fronts as parting strips. After carefully locating the dust panels, screws are driven through the sides to hold them in place. Holes for the screws are counterbored for plugs to conceal them.

Drawer construction is shown in Fig. 2. The side, back and front panels are grooved to take a plywood bottom, the front panel is rabbeted at both ends to fit between the sides, and then all four pieces are screwed together. For drawer pulls you can use large wooden knobs about $2\frac{1}{2}$ in. in diameter by $1\frac{1}{4}$ in. thick. These are used also on the drop leaf. The pigeon-hole unit, Fig. 4, is built separately



wood can be given a slightly silver cast called "pickled pine," obtained by giving the wood a wash coat of white shellac followed by a light maple wiping stain applied over it, and rubbing the entire surface with liquid wax to which some rottenstone has been added. The rottenstone will catch in the knots and bring them out clearly.

The desk top, sides and writing lid are made by gluing together several boards to the widths shown in Fig. 1. The foot pattern is cut in the two side pieces and in the front apron according to the scaled pattern, after which the sides are rabbeted for the back, which is plywood or hard-pressed

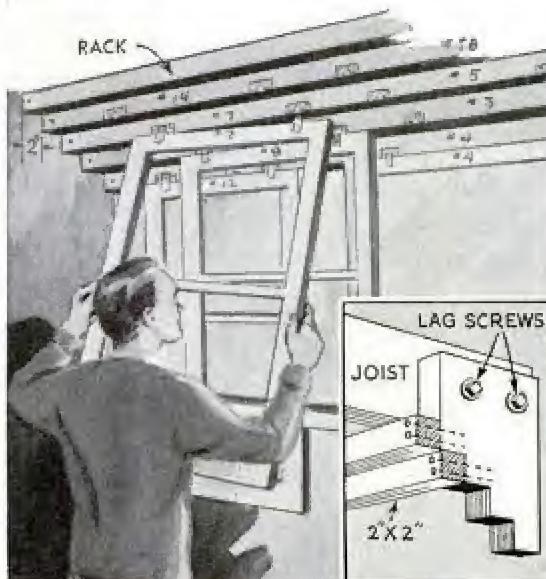
from $\frac{1}{2}$ -in. material, then set in place and held by strips of light molding. The secret compartment occupies the middle space, the cover being held in place against the stop strip simply by means of its snug fit. Next, the top of the desk is fastened to the sides by screws covered by concealing plugs, after which cove molding is run under the projecting edge of the top. The writing lid is hinged and the folding supports are attached. These may be taken

from an old desk or fashioned from pieces of metal. In fact, lengths of chain will serve equally well.

For the shelf unit, Fig. 6, use $\frac{3}{4}$ -in. stock to match the desk. Jigsaw the sides according to the pattern, Fig. 5, and rabbet the edge for the plywood back as shown in the circular detail. The shelves are of different widths from the wide one at the bottom to the narrow one at the top. Screws holding the shelves are covered with plugs like those in the chest. As a decoration, prints, decalcomania transfers or other colored designs of suitable size and shape can be applied to the back panel of the shelf unit.

Rack for Storing Storm Sash Safely Without Breakage

The problem of storing storm sash and window screens was solved by one man who hangs them on a rack like the one shown, where they are safe against breakage or other damage. Bolted to the ceiling joists or wall studs, the rack supports the sash and screens well above the floor in space not utilized in the average basement or garage. The rack consists of two end-pieces step-cut as indicated in the detail to receive 2 by 2-in. strips nailed to them. Hangers like those holding the sash and screens on the windows are screwed to these strips so that sash can be hung from them, each pair of hangers being numbered to correspond with the window to be hung on them. With this arrangement, each sash is hung on the rack as soon as it is removed from the window in the spring, at the same time taking down the screen from the rack and putting it up to the same window.—Edward E. Pape, New Hyde Park, Long Island, N. Y.



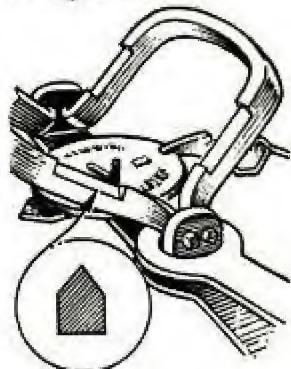
Warped Lumber Nailed Straight With Aid of Pinch Bar



Badly warped studs and joists often can be utilized by nailing them in place as shown. After nailing one end straight in place, hook a pinch bar over the edge near the other end and twist the board until the end is straight and then nail it in place.

Jaws of Steel Trap Beveled To Cut Through Trash

When the jaws of a steel trap are buried under leaves and small twigs, sawdust and similar material, it often happens that the trash will prevent the jaws from closing completely when the trap is sprung, thus allowing the animal to escape. To assure that the trap will hold under these conditions, one trapper files the lower ends of each jaw to the shape indicated, care being taken not to weaken the parts unduly. This edge will snap small twigs and will crush a thin covering of light material sufficiently to allow the jaws to close.



Model-airplane coverings will be more substantial if you cover the fuselage and wings with a layer of tissue paper before adding the final covering.

Handkerchief Knotted to Belt Substitutes for Nail Apron



A simple method of keeping nails within easy reach when you haven't a nail apron and can't keep the nails in your trousers pocket is to tie a large handkerchief or similar square piece of cloth to your belt and fill it with nails, as shown in the illustration. This method is especially practical when you are working on a roof or otherwise in a crouching position which prevents you from putting your hand into your pocket.

—Corp. Robert A. Adams, Oceanside, Cal.

Battery Lamp From Old Tester

An old battery discharge tester will make an excellent inspection light for checking the electrolyte in the cells of a storage bat-

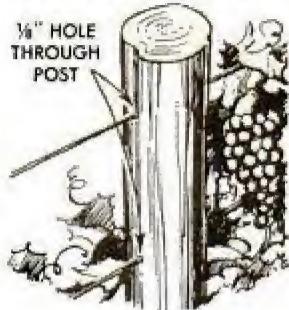


tery. To make a lamp from the tester, attach a flashlight reflector and lamp between the legs of the tester, using two pieces of heavy brass as indicated. In use, set the legs of the tester on the positive and negative connections of the battery. A $1\frac{1}{2}$ -volt flashlight bulb will then illuminate the interior of the storage-battery cell when the cap has been removed.

—E. R. Gorton, Maryville, Mo.

Wire Through Posts Holds Vine

Instead of stapping supporting wires to wood posts in the ordinary way, one vineyard owner bores small holes through each post and runs the wires through them. In this way, the wires are held securely, thus preventing the damage to vines and loss of fruit caused by staples pulling loose.



File Cards Arranged Quickly In This Simple Holder

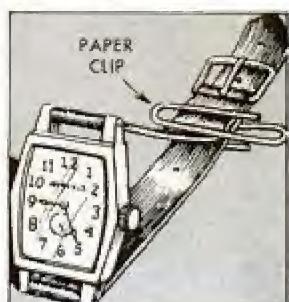


Where suitable drawers are unavailable to hold small file cards while arranging them in order, this simple cardboard holder will serve the purpose. Just fold the cardboard double and cut out a portion at the folded edge. This should correspond in depth with the height of the cards. If the sides of the holder tend to slide apart on the desk, a slotted strip of cardboard slipped over one end will stop the trouble.

—Don Brooks, New Caledonia.

Wrist Watch Supported Upright On a Table by Paper Clip

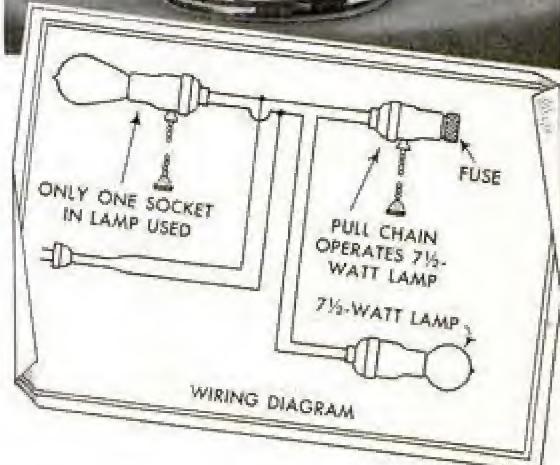
If you do not wear your wrist watch at night, fold the strap as shown and secure it with a paper clip. It will then rest vertically on a table so that the face can be seen from your bed.



Water-Filled Table Lamp Has Illuminated Base



Illuminated by the soft glow of a small light, this tropical-fish aquarium forms the base of an attractive table lamp which you can assemble in a short time. First get a large-mouth bottle—about 25-lb. size—having a Bakelite screw cap at least 4 in. in diameter. A two-socket assembly from a discarded lamp is fitted to the cap, using a flange, washers and nuts as shown in the detail. A keyless socket inside the cap is fitted to a length of tubing bent to a U-shape and connected to the vertical pipe by means of an elbow. Electrical connections are made as shown in the diagram so that one of the upper sockets, fitted with a fuse, serves as a switch to control the small light in the cap. Two double-wire lamp-cords are pushed through the vertical pipe; one pair comes out of the pipe just above the flange on the cap for connection to a baseboard plug, and the other runs to the small lamp in the cap. Air vents are drilled in the cap and the metal parts inside it should be given a coat of asphaltum paint as a protection against moisture. Although the original model shown in the photo was used for tropical fish, the bottle may merely be filled with water to which pieces of coral, shells and some small water plants



are added. However, this aquarium was not intended for goldfish, since they require more oxygen than this tank provides. The tropical fish, however, can live comfortably in the relatively small quarters.

Noise From Circular Saw Deadened by Wood Disk Placed on Arbor

I found that much of the noise of my 8-in. circular saw could be eliminated by placing a 3 1/2-in. disk of 1/4-in. plywood or hard-pressed board against the outside of the saw blade. A hole is drilled in the disk for the arbor, the disk being faced either with a sheet of thin cork or rubber. It can

be installed merely by removing the nut from the arbor, placing the faced side of the disk against the blade and screwing on the nut. It is important that the nut be drawn up tight enough to eliminate any wobble that might result.

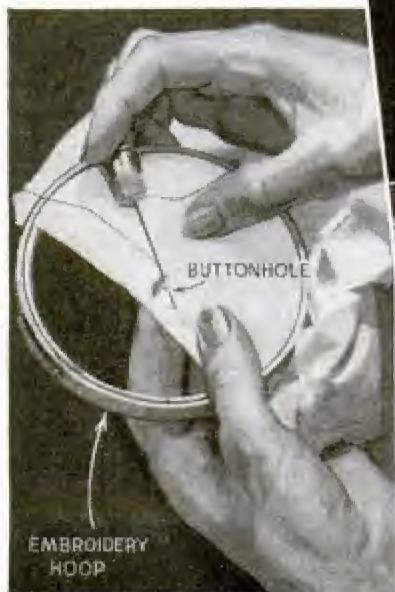
—D. H. Johnson, Lakewood, Ohio.

Solving HOME



It's no problem to iron curtains so they will hang straight if you use two stitched lines on the ironing board and then stretch and iron the curtains so they touch the lines

Making neat buttonholes need be no trouble if you use a pair of embroidery hoops as below. With the cloth stretched taut by the hoops it is easy to stitch around the hole and produce a good job



Add a novel touch to your party by painting the guests' names on the drinking glasses with nail polish, which can be taken off with polish remover



The annoyance of having comforters slip off the bed can be avoided by holding them with clothespins tied to elastic which is passed under the mattress corners



If a favorite piece of jewelry discolors your skin, clean it and then coat the back with clear nail polish



Excess fat can be removed easily from hot soup with an ice cube wrapped in a clean cloth as shown above. The fat congeals quickly on the cold surface of the cloth, which then can be washed in clean hot water

PROBLEMS

A wet chamois will not dry hard and stiff if it is hung outside in the wind, or on a line in the breeze from an electric fan so that it is kept in motion while drying



Coffee will hold its flavor longer if kept in a tightly closed container inverted on a shelf in your refrigerator



It's easy to keep toasted bread warm with a toaster of the type shown above. Simply fasten a piece of screen wire on top of the toaster to provide a shelf for the toasted bread



If the children have no place to store their small toys, a container made by tacking wire mesh to a plywood back and screwing it to a closet door as above solves the problem



Before removing a plant slip started in water, add soil gradually to replace the water. Break away the jar and the plant will grow when it is potted



An ordinary saltshaker provides a handy toothpick dispenser if cellulose tape is used to close all openings except the center one, which is enlarged to pass the toothpicks



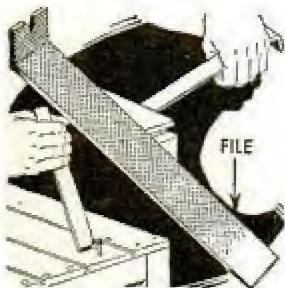
Home Repairs

Inexpensive Way of Insulating Your Home Heating Plant



If the boiler or furnace in your home makes too much heat in your basement, it can be insulated and this heat saved for the rooms upstairs by using batts of the mineral type of insulation, which is fire-proof. A carton of ten 15 by 24-in. batts will insulate the average small furnace or boiler and is quite inexpensive. Two people can best do the job. Start by first putting a layer of the batts around the lower part of the furnace or boiler, holding them in place with a wire or cord as indicated. After the layer is in place, stretch wire mesh or chicken wire over the batts to hold them in place permanently, attaching the ends of the mesh to the front of the furnace. Then proceed with the next layer of batts and so on until the entire surface is covered. These batts have a paper covering on one side, which should be placed outward. Care must be taken to protect the paper with asbestos paper if it comes near a fire door.—C. Lundy, Floral Park, N. Y.

Box-Opening Tool From Old File

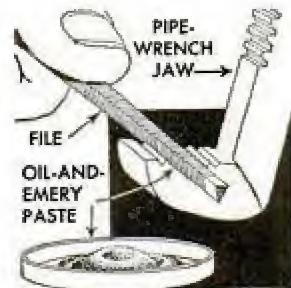


An old 12-in. file can be made into an excellent tool for opening wooden packing cases. First, grind down one end to a chisel shape and then heat the other end and bend it at right angles as in-

dicated, grinding a notch in it to provide a nail puller. In use, wedge the chisel end between boards to be parted and tap the other end with a hammer. This will loosen the nails so that they can be pulled with the notched end.

Renewing Teeth on Pipe Wrench

If the teeth of a pipe wrench have become battered and worn so that the wrench no longer grips the work securely, they can be recut easily. Since the jaws of most pipe wrenches are too hard to be recut



with a file alone, you will have to use some fairly coarse emery powder. Mix the powder with heavy machine oil to produce a stiff paste. Then, after clamping the wrench jaw in a vise to hold it, rub the paste over the teeth and with a slim, triangular file, preferably an old one, taking full, heavy strokes to reshape the teeth.

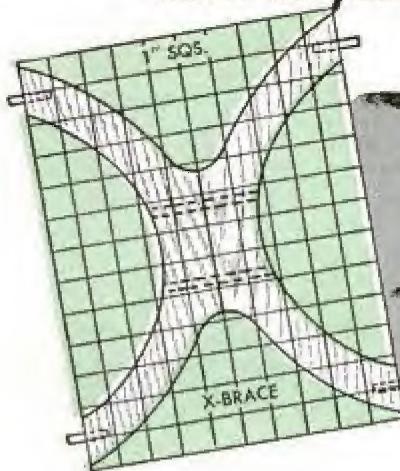
—W. C. Wilhite, Carlinville, Ill.

Envelope Slipped on Auto Visor Provides Handy Extension

A large envelope placed over the end of a car sun visor provides an excellent emergency extension. Many sun visors are too short to catch all the light rays, especially when driving early in the morning or late in the afternoon.



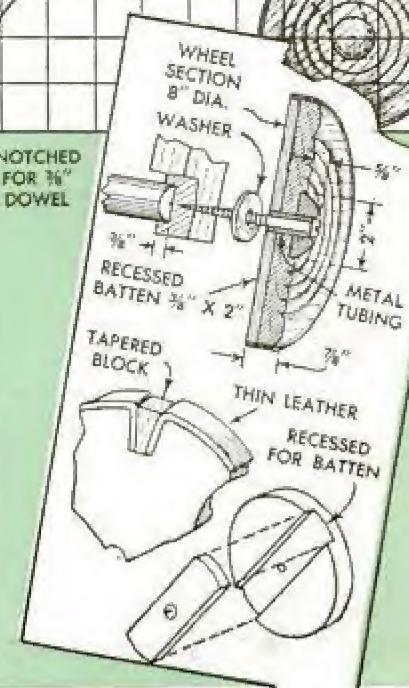
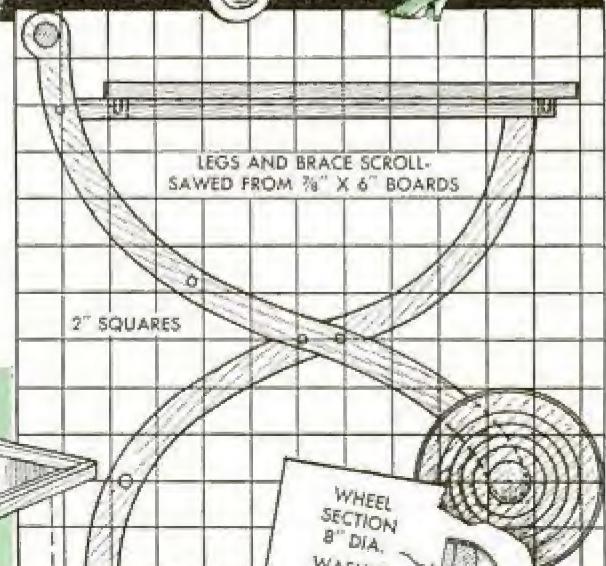
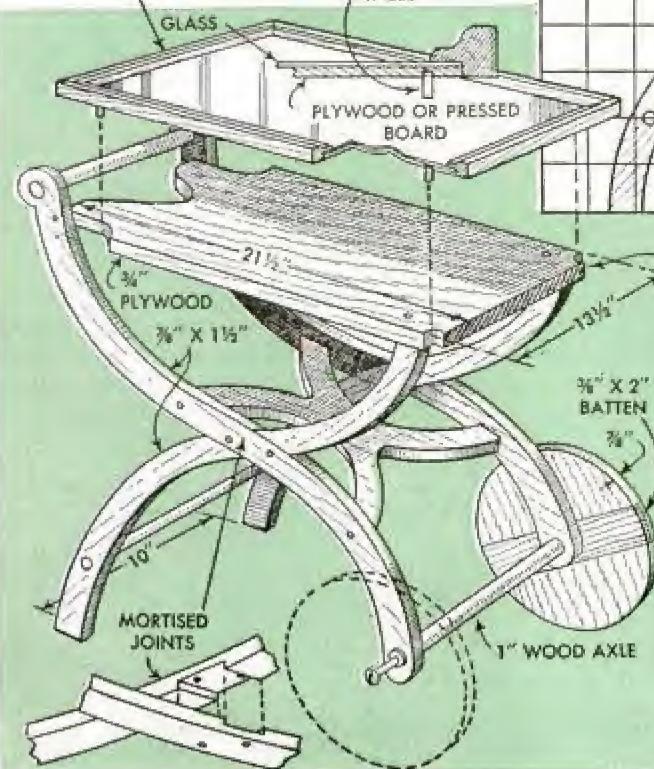
This TEA CART has a picture-frame tray



An old picture frame backed with plywood provides a removable tray for this tea cart, the sides of which are X-shaped assemblies mortised and glued together. An X-brace at the center and a $\frac{3}{4}$ -in. plywood top doweled to the sides provide rigidity. Wheels are wood disks metal bushed to rotate on heavy screw spindles. Battens recessed into the inner surfaces of the wheels prevent warping and leather tires protect the finish of polished floors

14 $\frac{1}{2}$ " X 20" PICTURE FRAME

DOWELS SERVE AS LEGS WHEN TRAY IS SET ON TABLE



Game Boards Stored Under Table And Held in Place by Springs



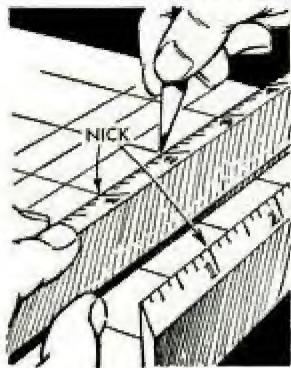
Game and playing boards of various types are kept out of the way yet ready for instant use if they are stored under a card table. Two screen-door springs stretched across the bottom of the table will hold the boards securely.

—Ronald Eyrich, Milwaukee, Wis.

Knee Linings Protect Trouser From Perspiration Rot

Ruining of woolen trousers at the knees due to perspiration is avoided if the inside of each trouser leg is lined for about 7 in. with the finest grade of oiled silk. By sewing through the seams, no stitching is visible on the sides, and the top and bottom edges are held by "whipping" over the edges with a stitch that does not go clear through the trouser fabric. This lining is not affected by cleaning and pressing.

Ruler Indicates Measurements When Drawing a Line

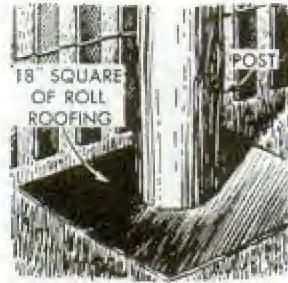


Indicating 1, $\frac{1}{2}$ and $\frac{1}{4}$ in. when drawing a line, this ruler is a handy adjunct to any drawing table. Shallow, sharp nicks are made in the ruler edge with a small triangular file, each nick being accurately placed op-

posite the marking. When using the ruler as a straightedge to draw a line the measurements are indicated by tiny jogs in the line. In addition to accurate measuring, the nicks indicate the proper spacing of cross lines when ruling is to be done.

Weed Growth Near Fence Posts Prevented by Guards

To save a lot of hand work trimming weeds and grass away from fence posts bordering a large lawn, one home owner cuts square pieces from discarded roll roofing and fits these about the posts. The roofing squares smother out any growth close to the posts.



Cardboard Box Lid Holds Screws While Painting the Heads



If you wish to paint the heads of screws before using them, just drive them part way into the cover of a cardboard box. This will hold the screws so that you can paint them with a sweep of a brush.

Glue Shot Into Furniture Joint With Grease Gun

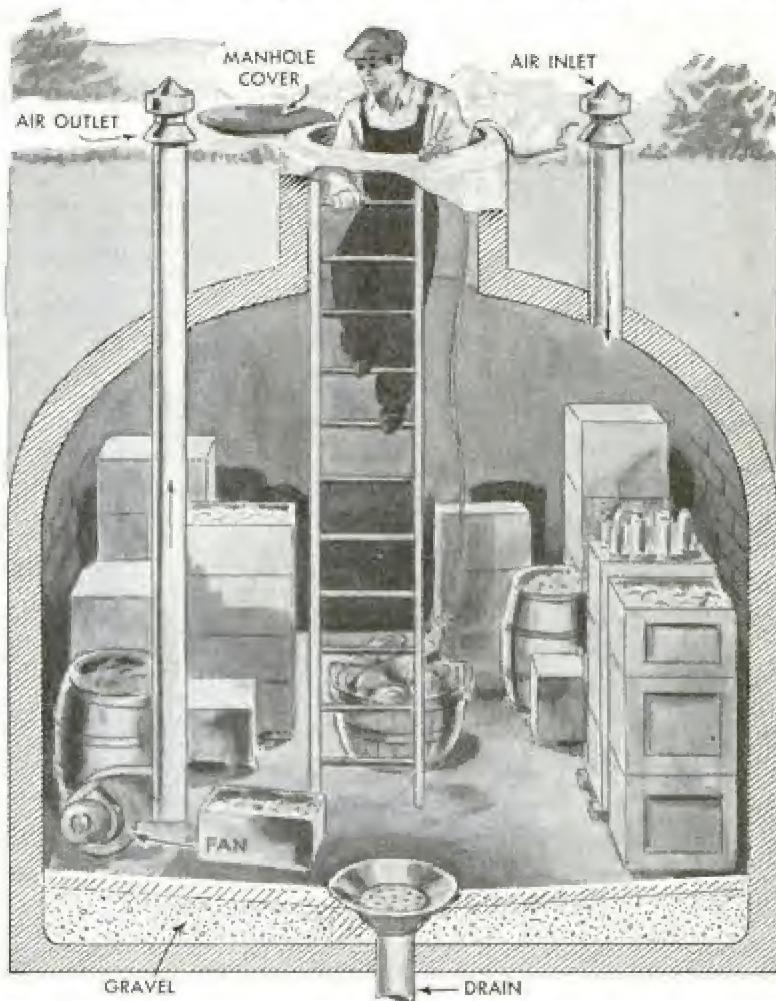
When mortise and tenon joints in furniture have loosened, and construction will not permit further loosening for insertion of waterproof glue, this can be forced in with a small grease gun. A small hole is bored in the underside of the rail and aimed to come alongside the tenon. Cabinet shops will find this idea useful for making quick repairs on loose joints of this nature.



Old Cistern Made Into Vegetable Storage Cellar

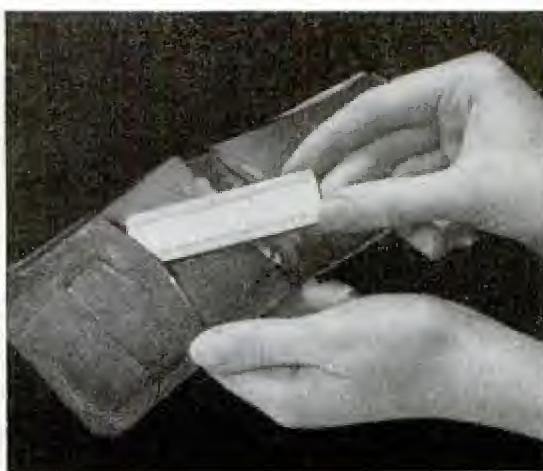
Having an old cistern that was no longer in use, one gardener converted it into an ideal vegetable storage cellar. About 12 ft. deep and 10 ft. in diameter, the cistern had two intake pipes which were disconnected at the downspouts and plugged with concrete. The opening at the top was enlarged so that large boxes and baskets of vegetables could be lowered through it, after which it was fitted with a manhole cover, obtained at a junk yard, to make the opening rain tight. Then an opening was broken through the concrete bottom of the cistern and a drainpipe installed, the pipe reaching down into a layer of sand and gravel to provide good drainage. The pipe extended about 2 ft. up inside the cistern, which was then filled with gravel almost to the top of the pipe. On top of this was poured a new concrete floor, the layer of gravel between the floors assuring dryness.

Next, two ventilator tiles were installed to extend above the ground. The inlet pipe just reached through the top of the cistern and the outlet pipe was extended to within a few inches of the floor. A small exhaust



fan of the type used in kitchens was installed at the lower end of the outlet pipe. Operating the fan for a half hour two or three times a week keeps the cellar well ventilated.—Harry L. Spooner, Peoria, Ill.

Midget Ruler to Carry in Your Wallet Has Many Uses



By cutting a 6-in. ruler in two, you will have a rule that will slip into your wallet and always be handy when needed. Experience has shown that a good percentage of simple measurements are 3 in. or under. However, many 6-in. rules can be "hinged" in some manner to make them fit in a wallet or other small space.

PASSING UP AN OPPORTUNITY?

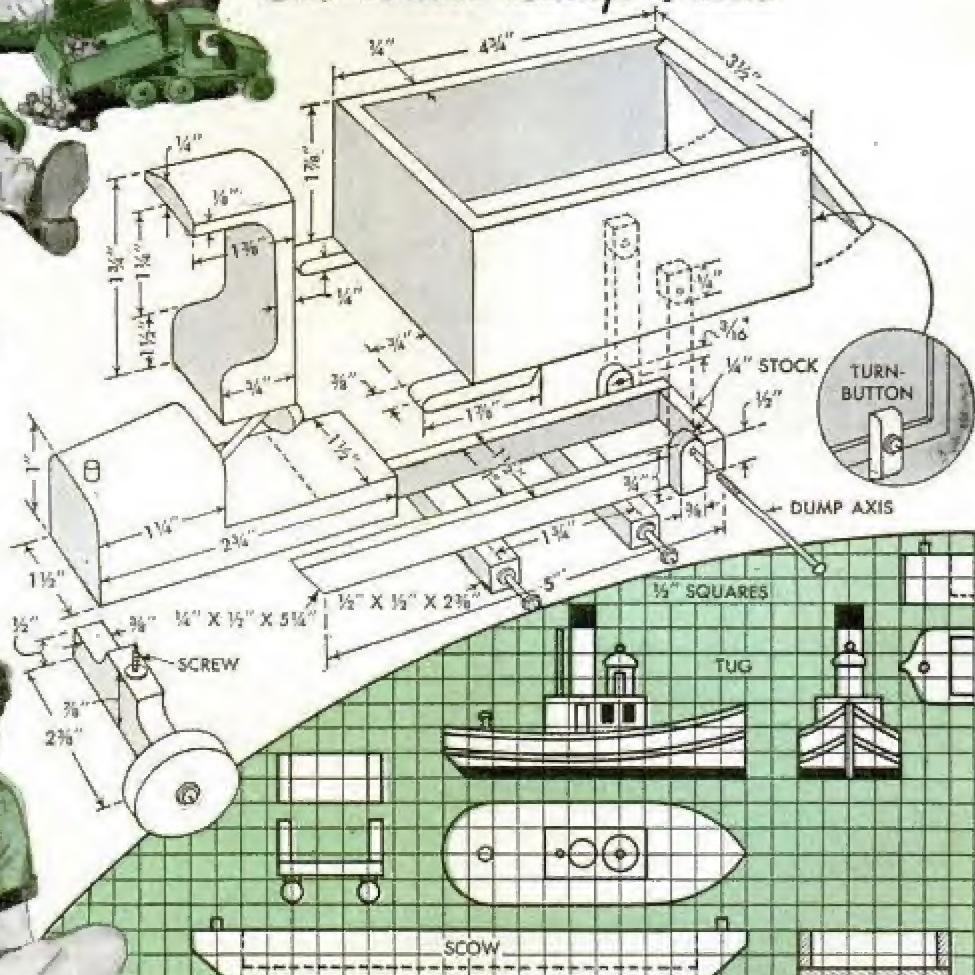
Have you ever said "That's a good idea for Popular Mechanics" but you failed to send it in? Next time, don't pass up an opportunity—write a short description, include a clear photo or drawing, and mail it to the Homecraft Editor. If your idea is accepted, a check will be sent promptly.

WHAT to MAKE for

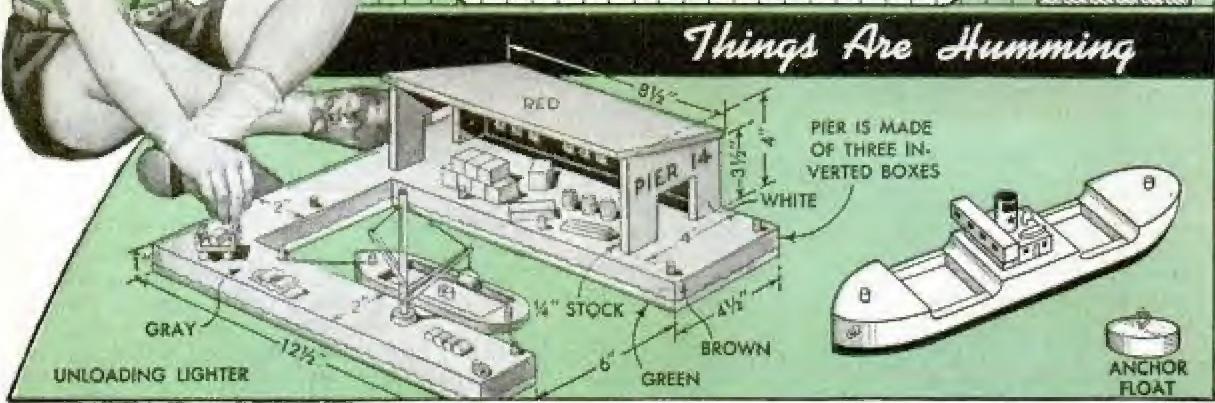


Any child will like this wooden dump truck which empties its load from the rear end when the body is raised. The endgate is pivoted at the top on brads, which are driven through the sides, and is locked by a tiny turnbutton at the lower side. Cab and hood are band or scrollsawed from solid blocks. The steering wheel is a button glued to a dowel steering post.

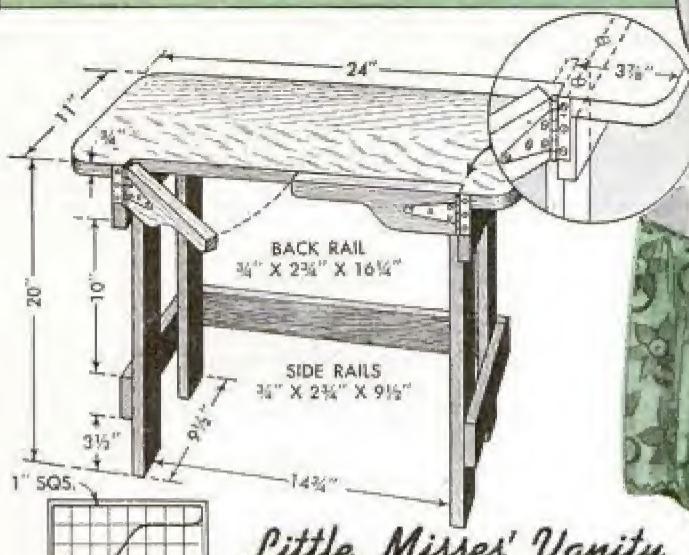
Six-Wheel Dump Truck



Things Are Humming

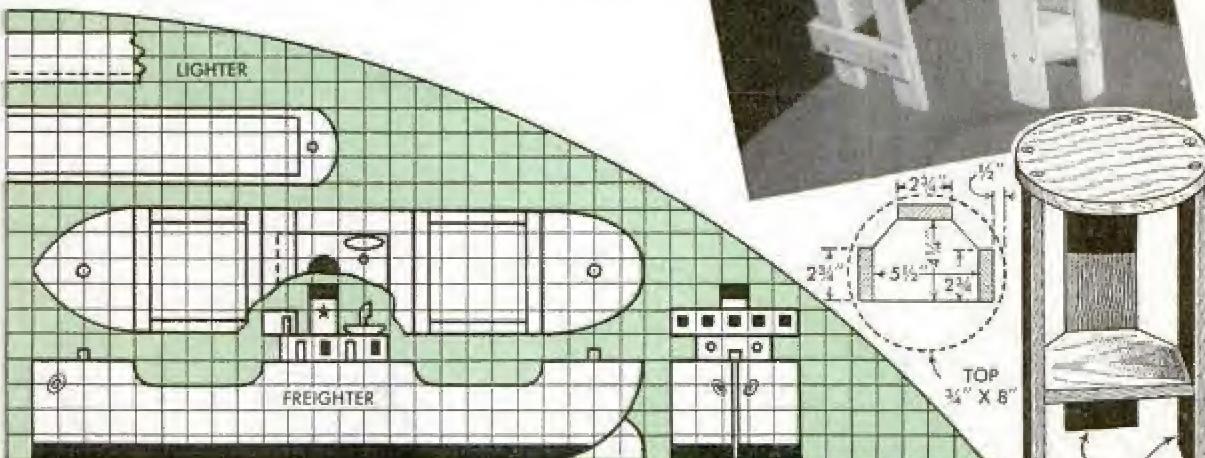


CHRISTMAS GIFTS

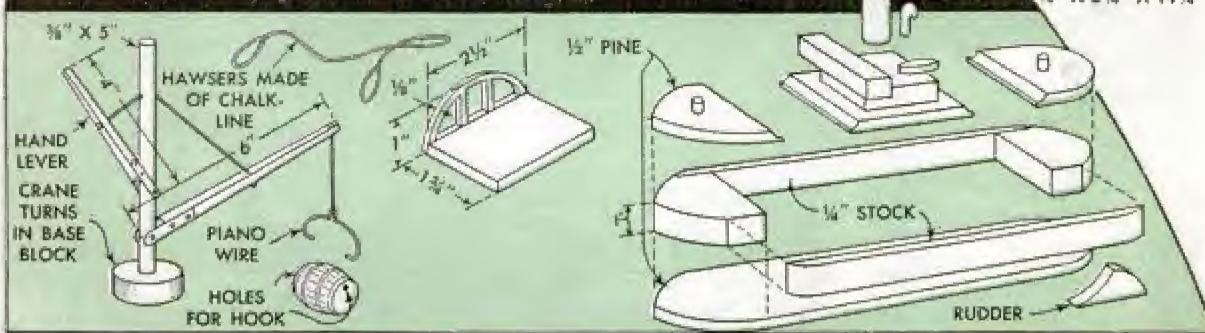


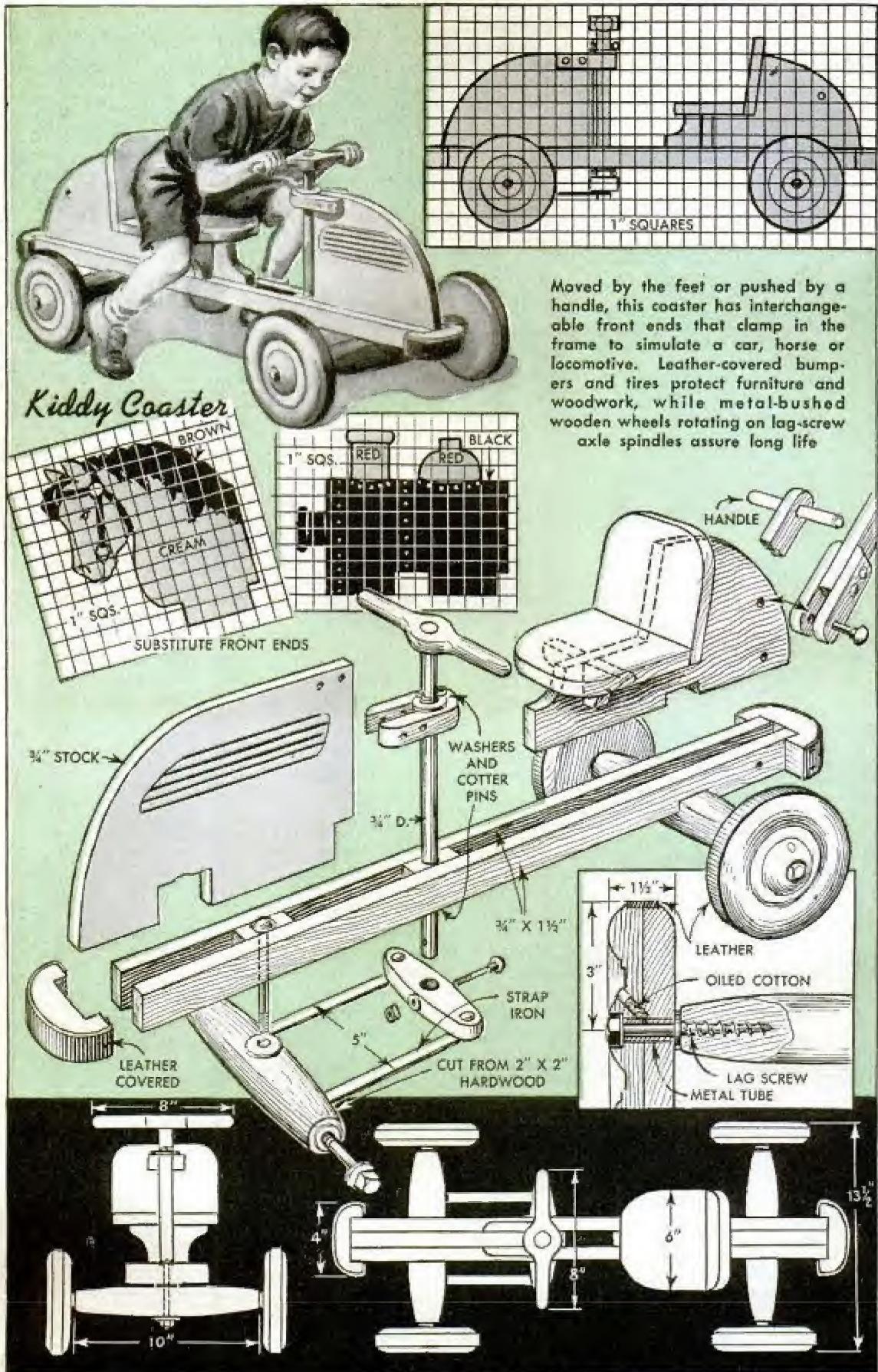
Little Misses' Vanity

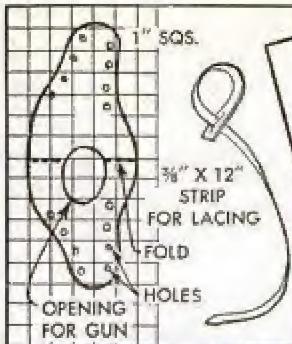
Just like mother's, this little girl's cretonne-covered vanity has a stool to match. The wooden frame is sanded smooth to remove splinters before painting. Top may be painted only or covered with linoleum. The cloth skirt, which reaches the floor and goes around the front and ends to hide the framework, can be tacked to the top for easy removal when cleaning. The seat is padded before it is covered



At Pier 14







Toy Gun Holster

The young commando will like this holster cut from rubber or fabric and bound with a colorful lacing



Turned Compact

Turned from walnut, this compact holds a mirror and puff. Bandsaw the rims so they telescope and hold together without a catch. Sand thoroughly and finish with two coats of synthetic shellac, rubbing down well with 4/0 steel wool

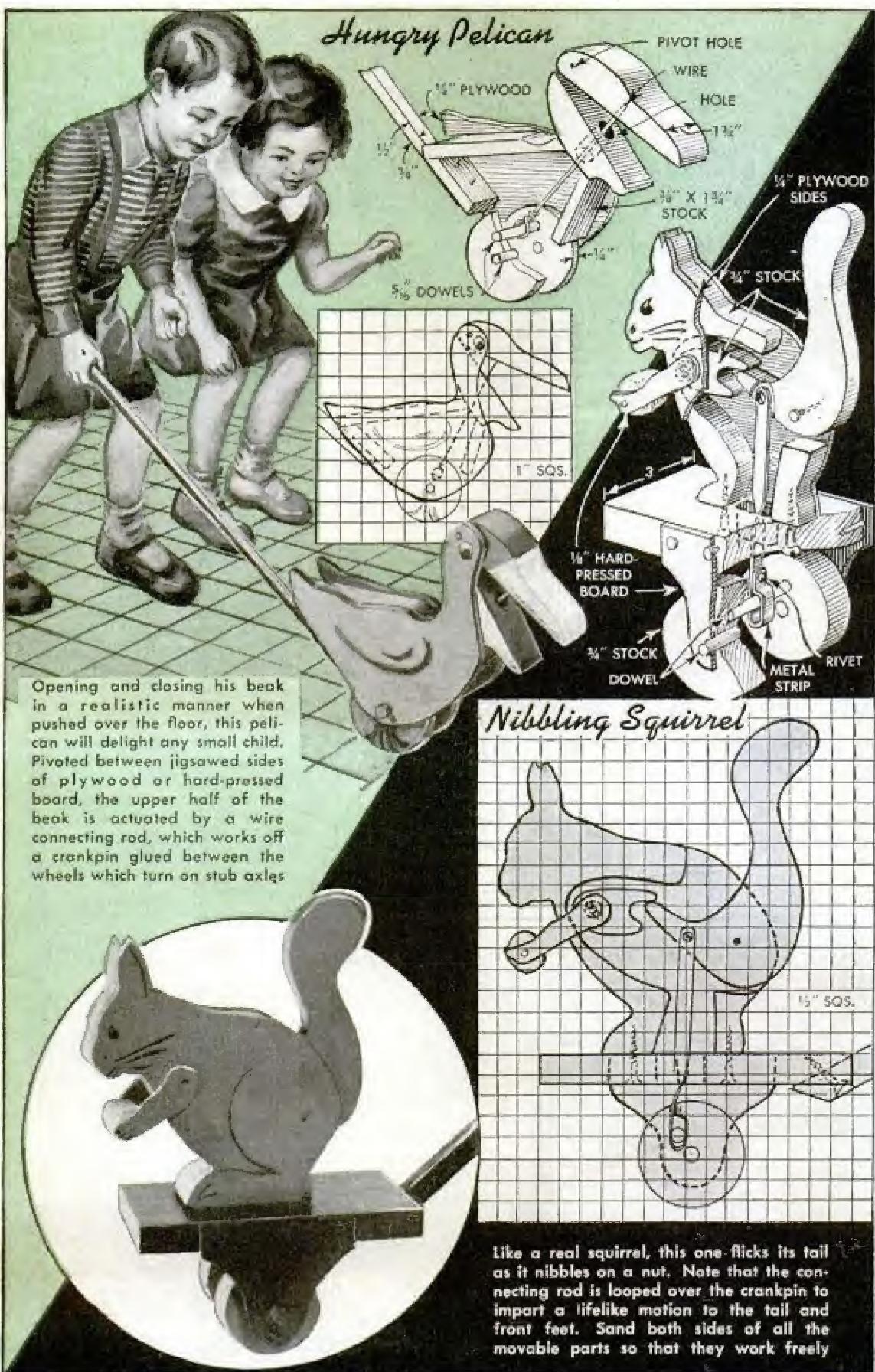
It's easy to make bracelets and necklaces from black walnuts. After completing the procedure below, wax and polish the slices, and then string them, using thread for the necklace and small, round elastic for the bracelet.

SAWING
WALNUT

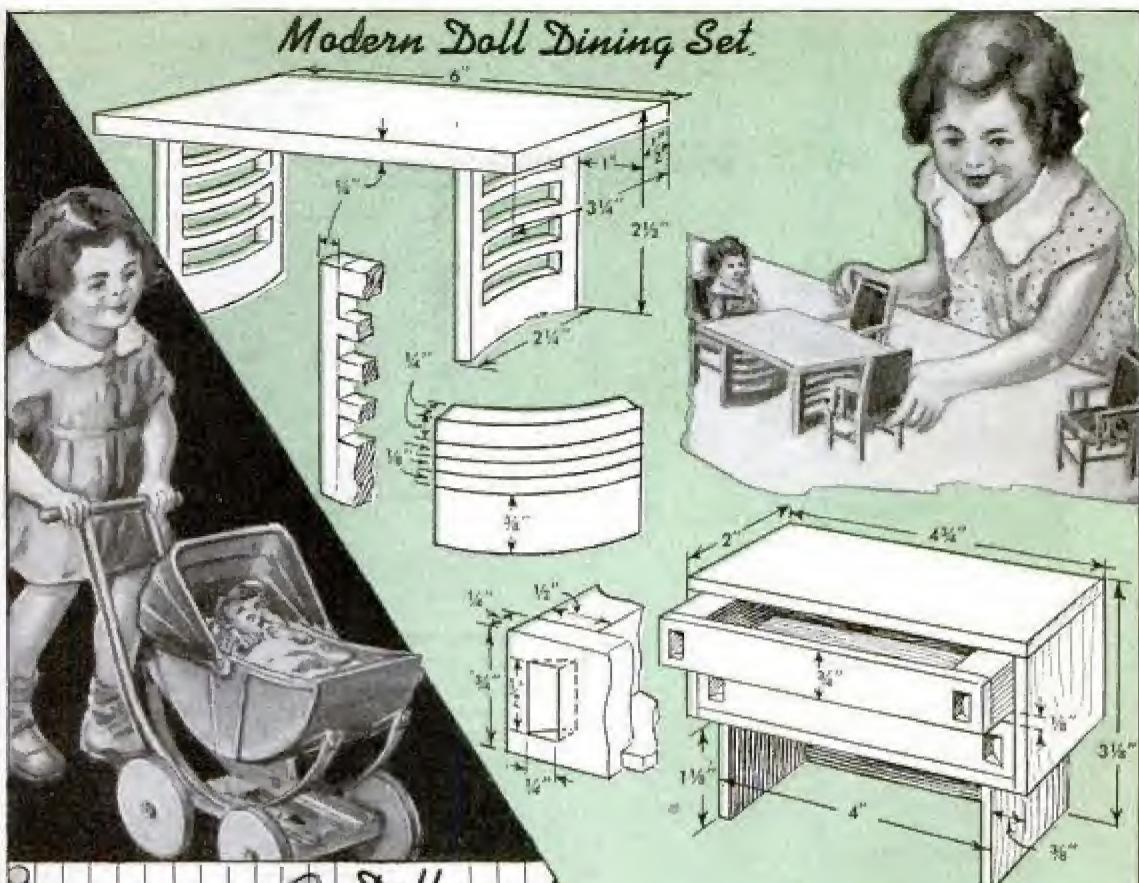
DRILLING

SANDING
NO. 00 SANDPAPER

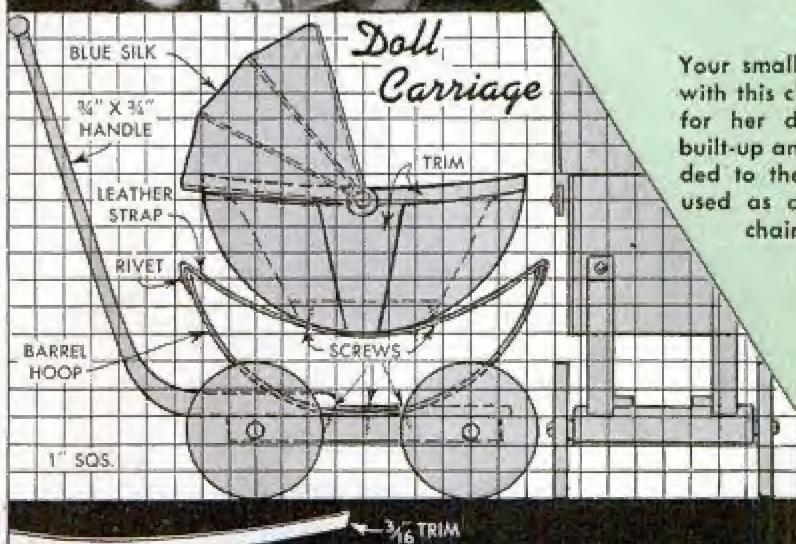
Walnut-Shell Bracelets and Necklaces



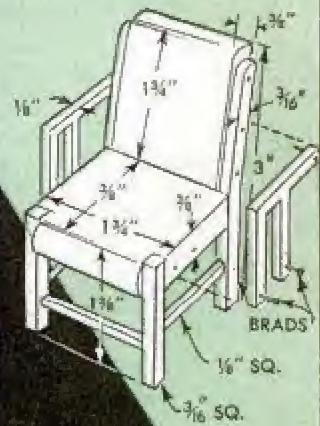
Modern Doll Dining Set.



Your small daughter will be delighted with this chair, buffet and dining table for her doll house. Table legs are built-up and the top is glued and brad-ed to them. The buffet can also be used as a bedroom dresser and the chairs will serve anywhere



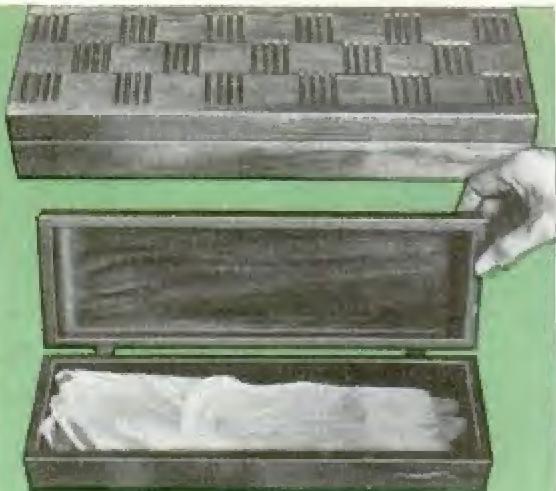
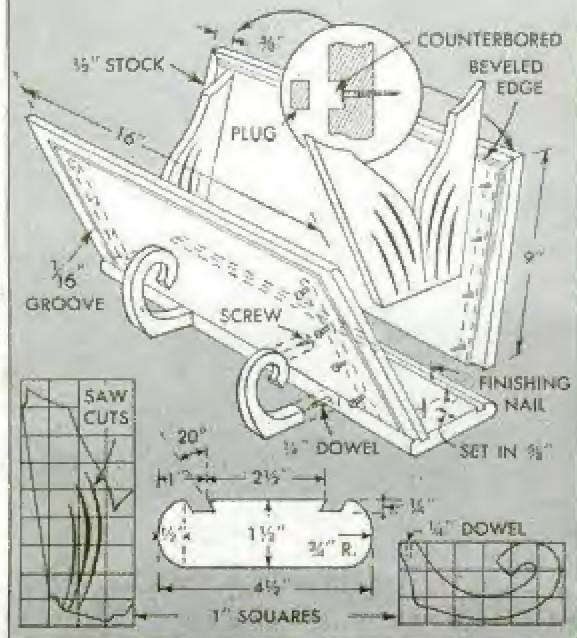
This doll carriage has a fabric shade stretched over a piano-wire frame. The springs are formed from barrel hoops cut in two and held to shape by straps





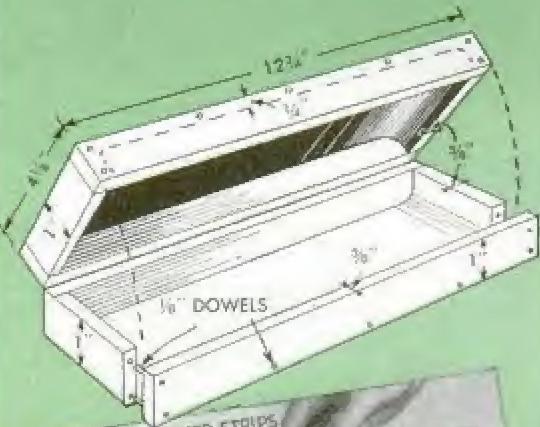
"Book" Magazine Basket

Walnut sides contrasting with maple ends make this unusual basket suitable in any room



"Woven-Lid" Glove Box

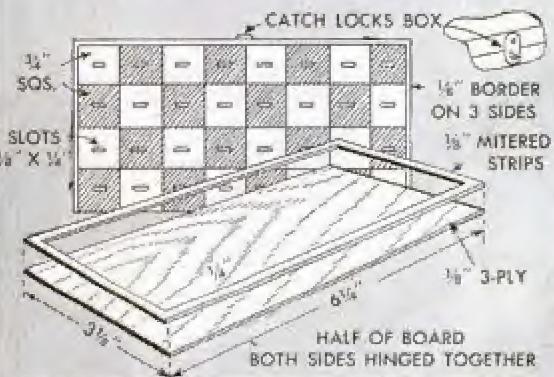
Unusual construction of this box eliminates the usual box corner joint. The novel woven effect on the lid is achieved by first grooving the solid stock and then ripping it into strips. These are staggered, doweled and glued together, and then band-sawed to correct thickness



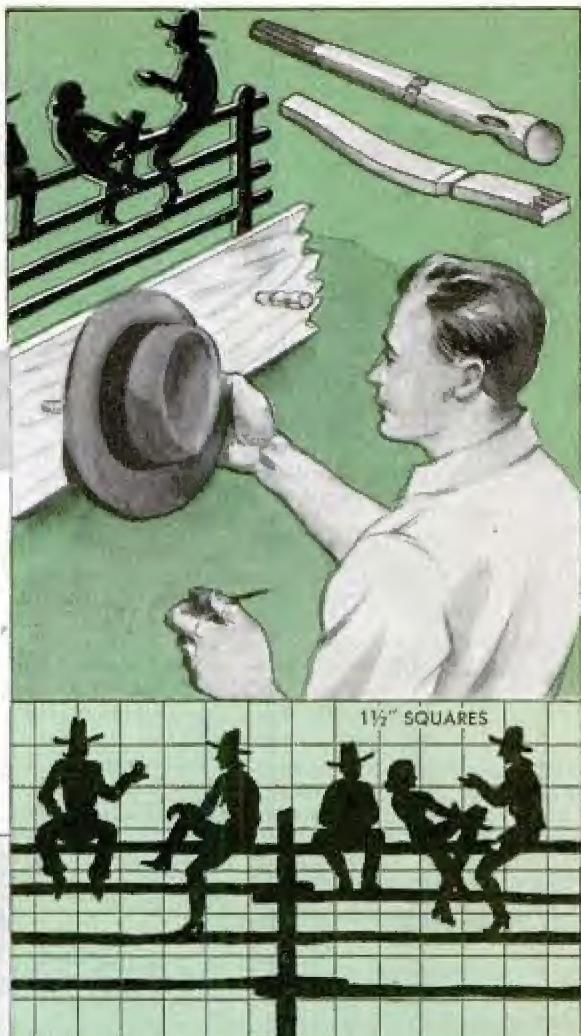


Pocket Chess Set

This pocket chess set is a welcome gift for service men because it folds compactly with the chessmen inside. Chessmen are flat and are jigsawed from $\frac{1}{8}$ -in. stock, each having a tab extending at the bottom to fit slots cut in the squares of the board to support them vertically.

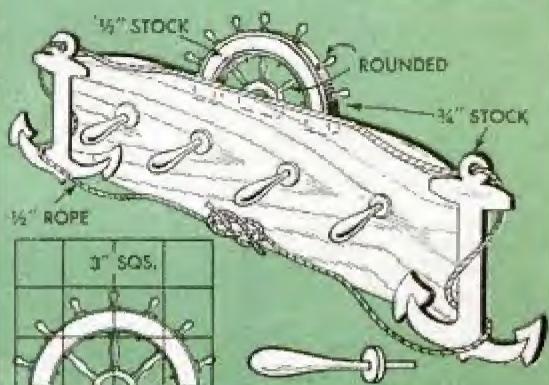
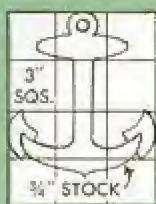


KING QUEEN BISHOP KNIGHT CASTLE PAWN
1 WHITE 1 WHITE 2 WHITE 2 WHITE 2 WHITE 8 WHITE
1 BLACK 1 BLACK 2 BLACK 2 BLACK 2 BLACK 8 BLACK



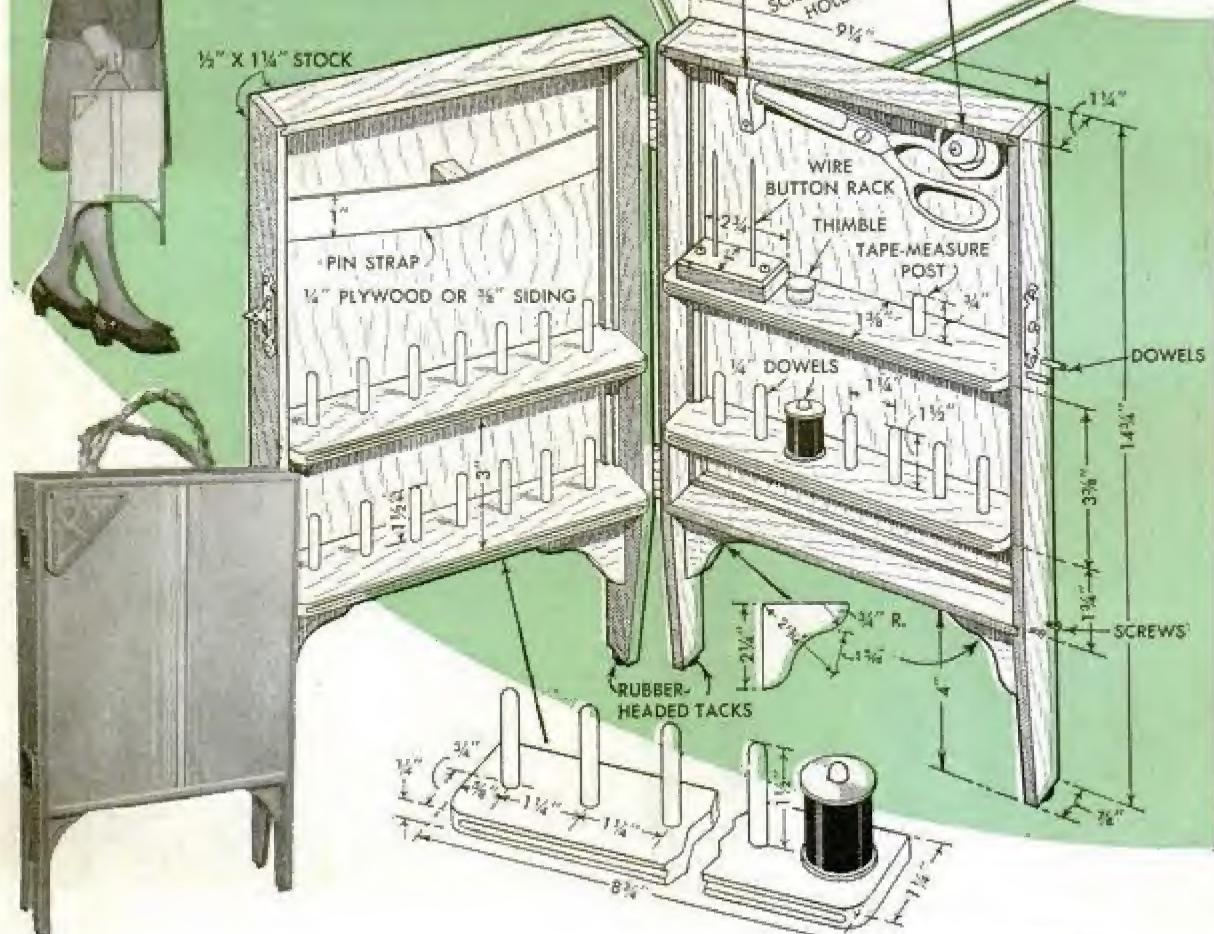
Hat Racks for the Outdoor Man

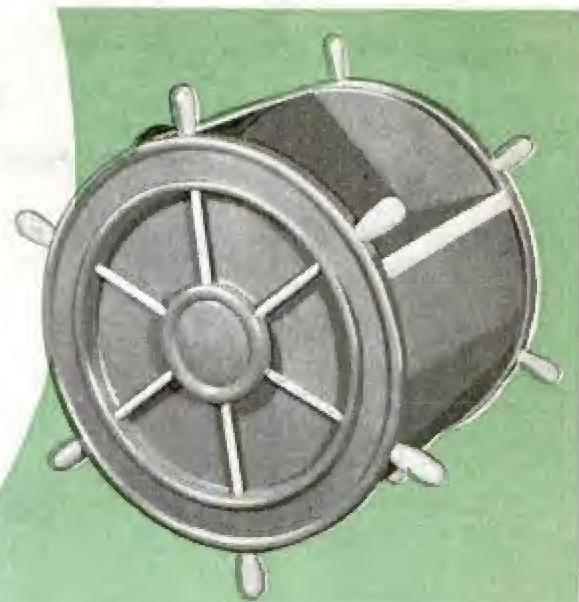
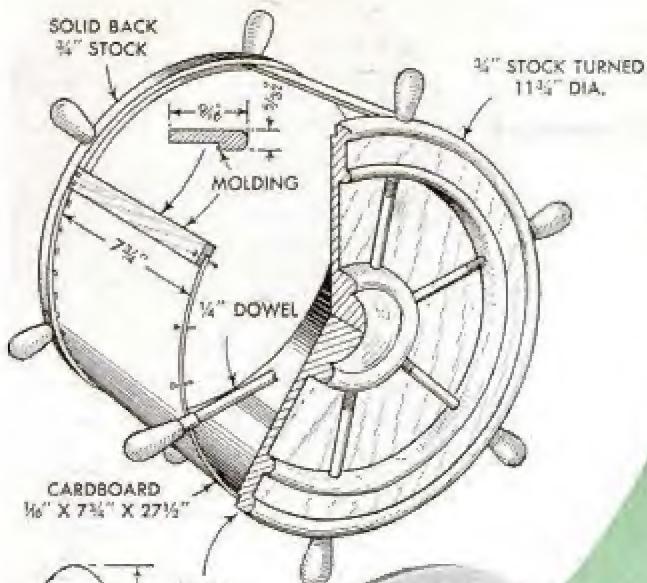
A scrollwork of "fence sitters" gives the rack above a pleasing western atmosphere, while an edging of rope and anchors topped by a ship's wheel makes the rack below distinctively nautical.



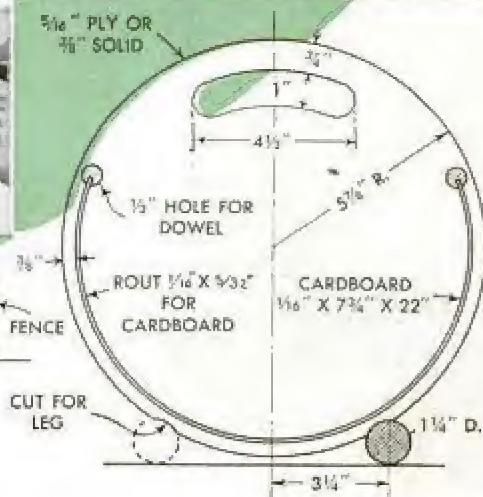
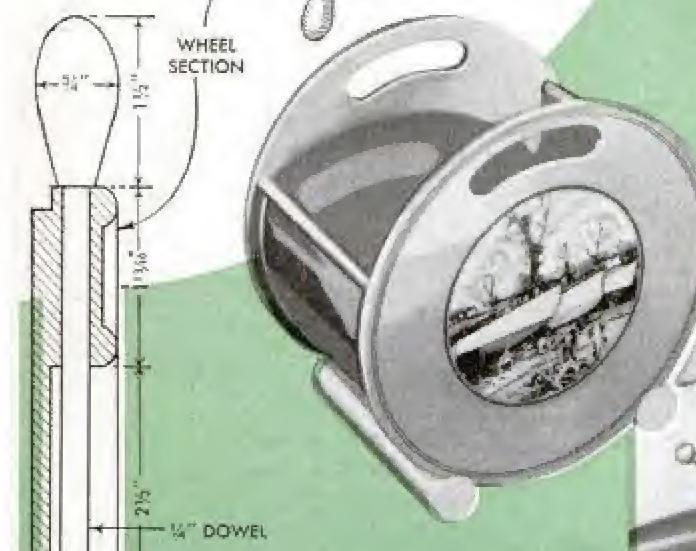


Sewing accessories always are at hand in this kit, which has a carrying handle that also serves as a stop to prevent opening the kit wide enough to tip over. A framework of $\frac{1}{2}$ -in. stock with front and back of $\frac{1}{4}$ -in. plywood makes an ideal assembly.





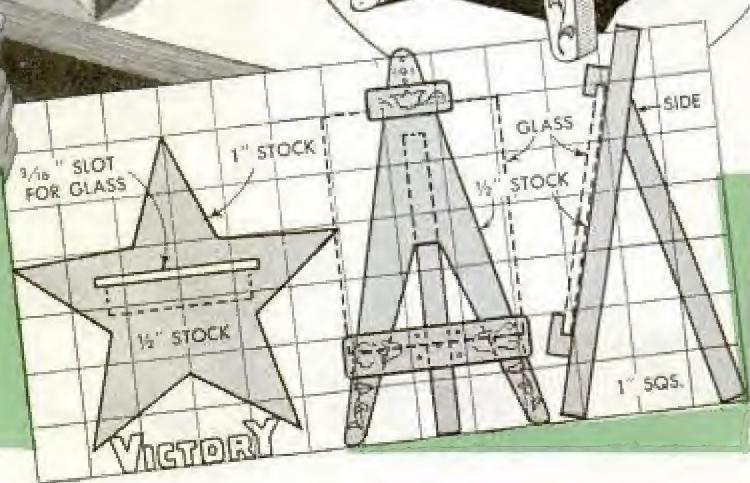
Unusual in design, these two wastebaskets look well in any room. The ship's wheel basket above consists of two turnings drilled as below for insertion of the spokes. Cardboard edged by molding strips at the basket opening and nailed in the rabbeted edges of the turnings hold assembly together



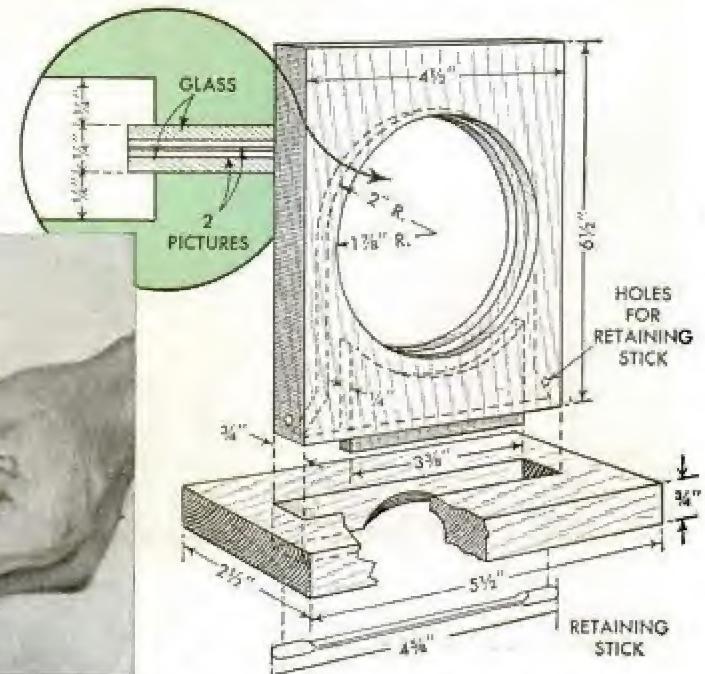
Picture Frames

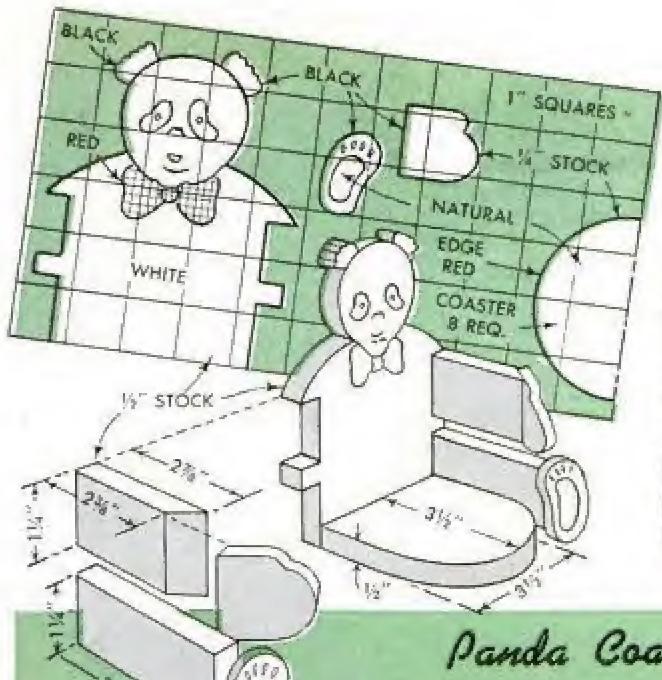


Holders for your snapshots are easy to make without troublesome framing. Just saw out an easel or a star-shaped base as above, place the picture between two pieces of glass, the edges of which have been filed smooth, insert the assembly in the holder and the job is done.



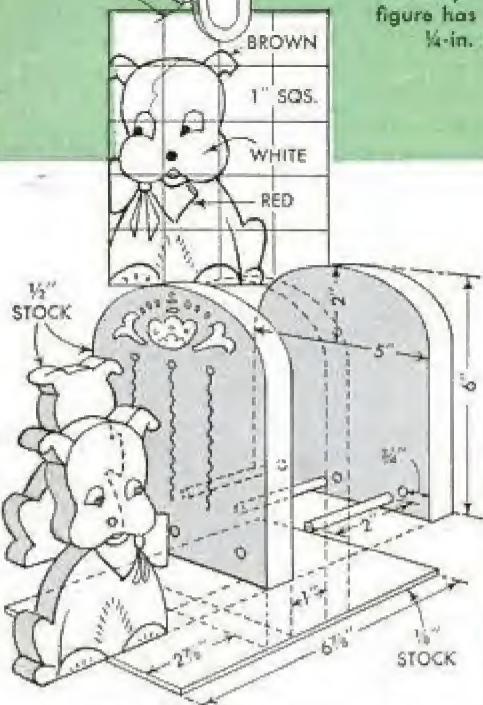
Pictures and glass are inserted through the bottom of this unusual picture frame and are held in place by a wooden insert, which in turn is secured by a hickory splint, the latter making it easy to dismantle and pack the assembly flat for convenient packaging or mailing. The splint, of course, projects through holes in the standard into blind holes in the base.





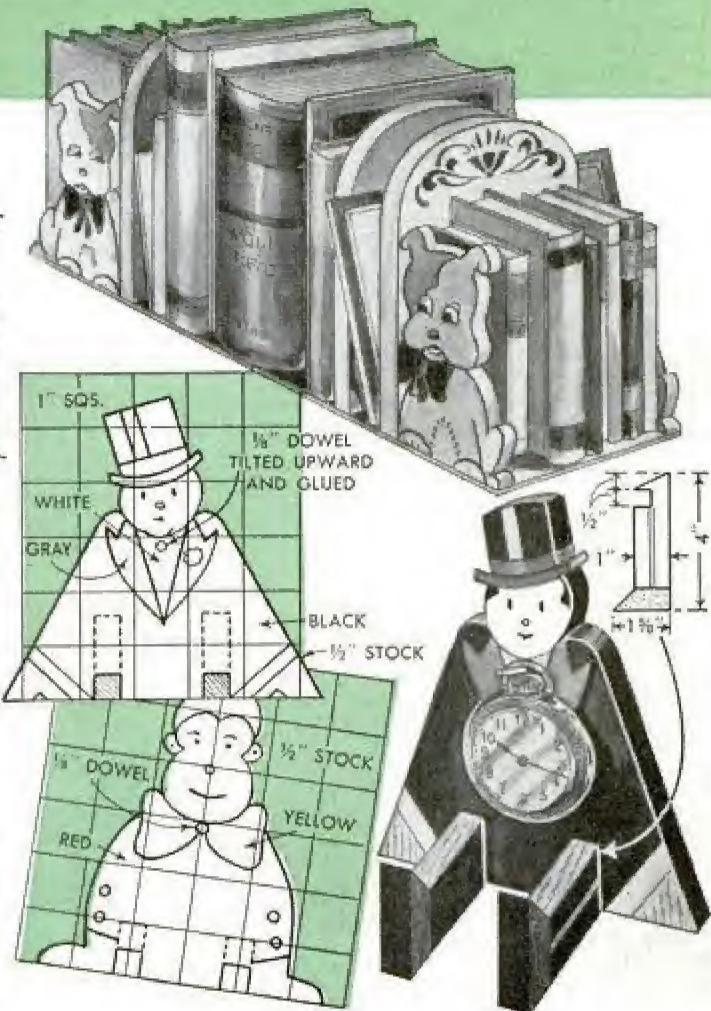
Panda Coaster Set

Patiently holding eight 3-in. coasters cut from $\frac{1}{4}$ -in. plywood, this little figure has a body cut from $\frac{1}{2}$ -in. stock and feet and hands jigsawed from $\frac{1}{4}$ -in. plywood. Painting suggestion is given in the upper detail.



Book Ends and Watch Holder

The problem of storing children's books of various sizes is solved with these book ends. Large books are placed between them and small ones are set at each end. There also is a place for pamphlets and papers. The novel holder at the right converts your old pocket watch into a useful dresser "clock." Note that the one-piece foot and leg is notched into the body.



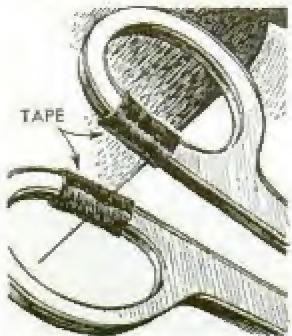
Corner Post of Barracks Bunk Holds Shoe for Polishing



Here's a suggestion for the boys in the barracks who sometimes grow weary of trying to shine their shoes without having a suitable support to keep them steady under a vigorously applied brush or a flapping cloth. As shown in the illustration, a shoe can be held fast between the corner posts of double-deck bunk beds with the heel placed on top of the lower post and the upper post set into the shoe. To avoid marking the heel or inside leather by the tenon which holds the posts together, a metal or plastic jar cover or a piece of wood or cardboard can be inserted in the shoe before it is placed under the post.

—Pfc. R. F. Crocker, Camp Campbell, Ky.

Shears Taped to Protect Hands



The fleshy part of your hand can be pinched severely in using tin shears, the flesh being caught unexpectedly between the handles. To avoid this, merely wrap a short length of tape around each handle as shown.

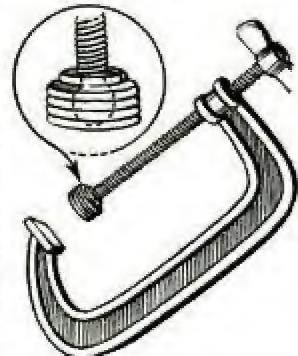
Sprinkle Sawdust on Icy Walks

The next time your sidewalk is covered with ice, sprinkle sawdust on it instead of the customary ashes, sand, or cinders.

Sawdust is superior to these materials because when the ice melts sand, ashes and cinders settle to the bottom and leave a slick surface when water freezes again, while sawdust floats. It may cling to the soles of one's shoes almost as tenaciously as ashes and sand but it does not ruin carpets or hardwood floors if tracked into the house. Also it absorbs moisture more efficiently and adheres to the ice just as well or better. After the ice has melted and the moisture dried, the sawdust remains but is easily swept or washed away.

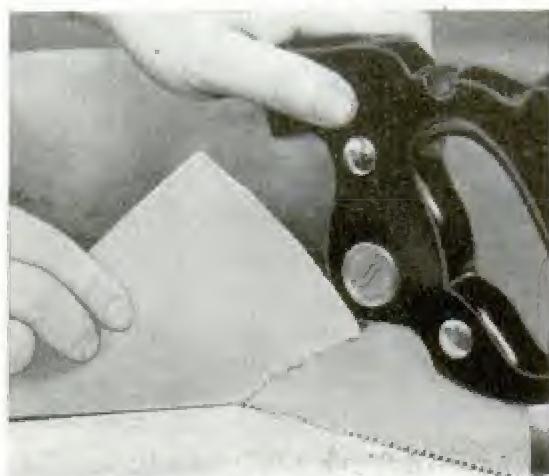
Renewing Pad on the Screw End Of Broken C-Clamp

If you are unfortunate enough to break the pivoted pad on the screw end of a C-clamp, the pad can be replaced with one built up from iron washers. To do this, first slot a washer that will not pass over the bead on the end of the screw, slip it over screw back of the bead and close the slot with a hammer. Then, apply three washers that will slip over the bead, and lastly a solid piece of metal at the end of these and weld or braze the assembly together.—Louis Coia, Tullytown, Pa.

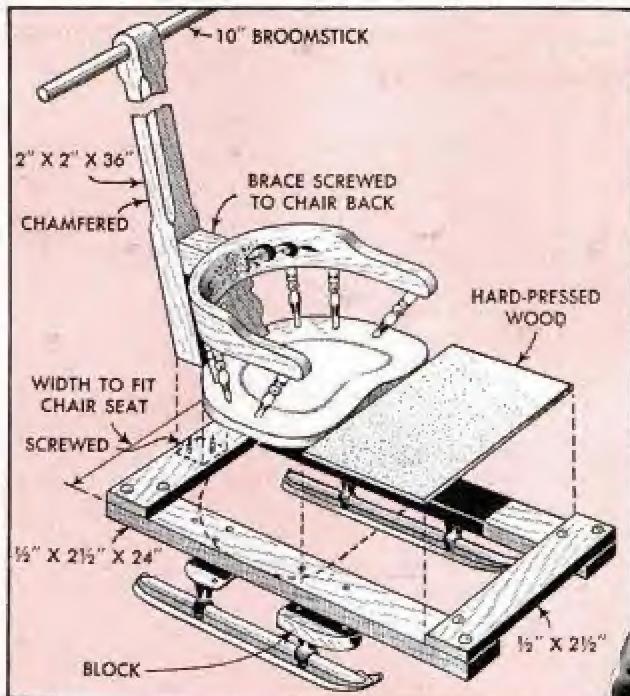


Tearing Paper Against Saw Blade Gives Neat, Uniform Edge

When it is necessary to tear wrapping paper, press a saw blade lightly against the paper and tear along the saw. This makes a uniform and neat tear either with or across the grain, and is especially useful if a number of narrow strips are needed.



Fun on the Ice With This Speedy Skate Sled

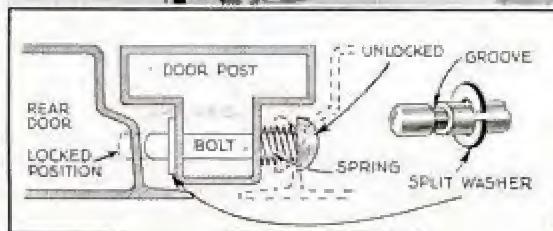
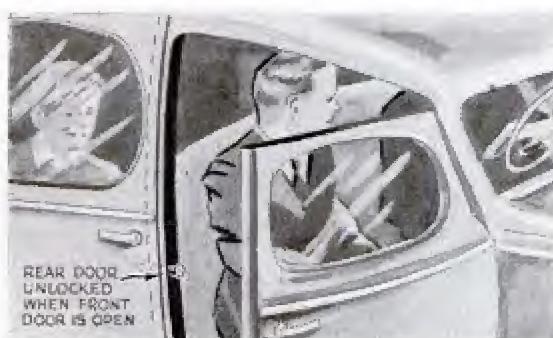


A pair of ice skates—an old pair will do—a few pieces of wood and the seat and back of a child's chair assembled as shown are all you need to make this push-type skate sled that will skim over the ice with ease. Use just the runners and foot plates of the skates, with a filler block on the front plate to raise it even with the rear one, and fasten the skates to the frame with screws. A brace reinforces the



handle as shown, and a piece of hard-pressed wood supplies a place for the rider's feet.—Harold Gluck, Bronx, N. Y.

Bolt in Car Door Partition Keeps the Rear Door Locked

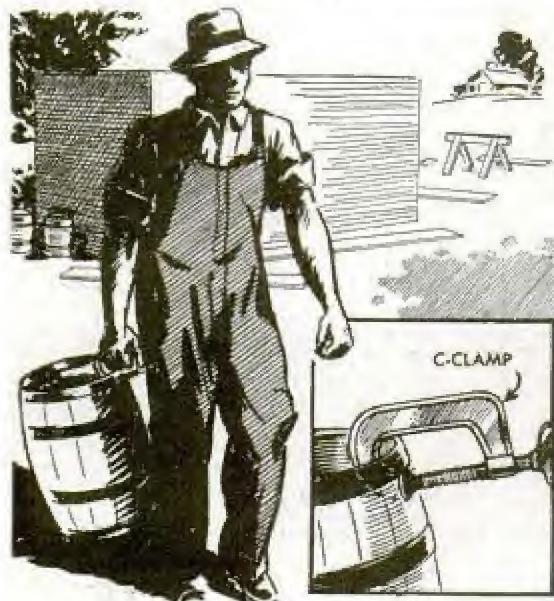


A sure way to keep children from falling out of a moving automobile by accidentally opening the rear door is to install a simple rear-door lock made by inserting a round-head bolt through the upright partition so that the front door, in closing, forces it through a hole drilled in the metal edge of the rear door to lock it securely. A coil spring slipped over the bolt forces it out of the catch when the front door is opened, and a split washer set in a groove near the end keeps the bolt from dropping out.

Kerosene Cleans Auto Radiator

A solution that will remove grease and grime from inside auto radiators can be made by mixing kerosene, 1 part, with water, 2 parts. Place this in the radiator, run the motor until the solution is boiling, then drain and fill with clean water.

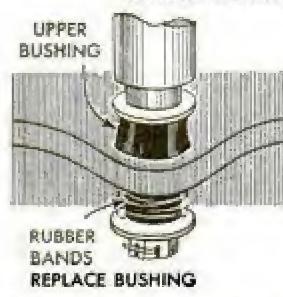
C-Clamp Used as Carrying Handle For Small Keg of Nails



C-CLAMP

The difficulty of carrying a small keg of nails because of the lack of a handle can be overcome by improvising a handle from a large C-clamp. Just attach the clamp to the keg as indicated. This idea can be used on only small kegs as the weight of larger ones likely would bend the clamp.

Silencing Worn Shock Absorber With Rubber Bands



When a rubber bushing in the linkages of some car shock absorbers wears or rots away and allows an annoying rattle to develop, it can be repaired temporarily with rubber bands until a replacement can be made. Just wind several bands tightly around the exposed shaft as indicated. On ball-and-socket types of linkages, pieces of old inner tube can be used instead of the bands.

replacement can be made. Just wind several bands tightly around the exposed shaft as indicated. On ball-and-socket types of linkages, pieces of old inner tube can be used instead of the bands.

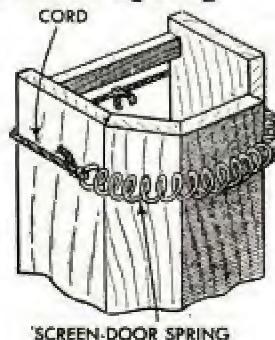
Fall Covering Saves Roses

Roses are in less danger of winter killing if the base of each plant is covered with soil or peat moss to a height of about 6 in. A covering of hay, straw, or leaves should be added after the ground has frozen. Another common practice is to tie the tops together and cut them off about 18 in. above the ground. Climbers generally should be removed from their supports and placed

along the ground, covered lightly with burlap or straw, while in very cold climates the climbers should have a dirt covering. Uncovering the plants a little at a time in the spring makes damage from late frosts less likely.

Column Clamp Made From Cord And Screen-Door Spring

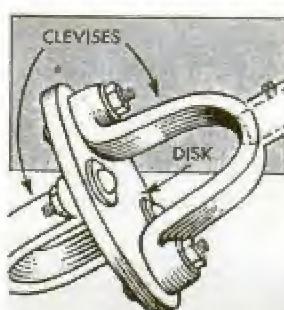
The next time you are building up a column or half column and there are no suitable clamps at hand, try some screen-door springs. Use as many as necessary and tie them around the work with strong cords as shown. Clamps of this type exert uniform pressure on all joints of the column regardless of its contour.



Reading Luminous Watches

To read a luminous-dial watch at night, which often is difficult because the minute and the hour hand cannot be distinguished from one another, I simply note the position of both hands in relation to the stem and then move them. In doing this, the minute hand is recognized because it moves the most. Then, I can return the hands to their approximate former positions and note the time. This method is not altogether accurate but works well enough in most situations.—Pfc. Andrew Vena, U.S. Army.

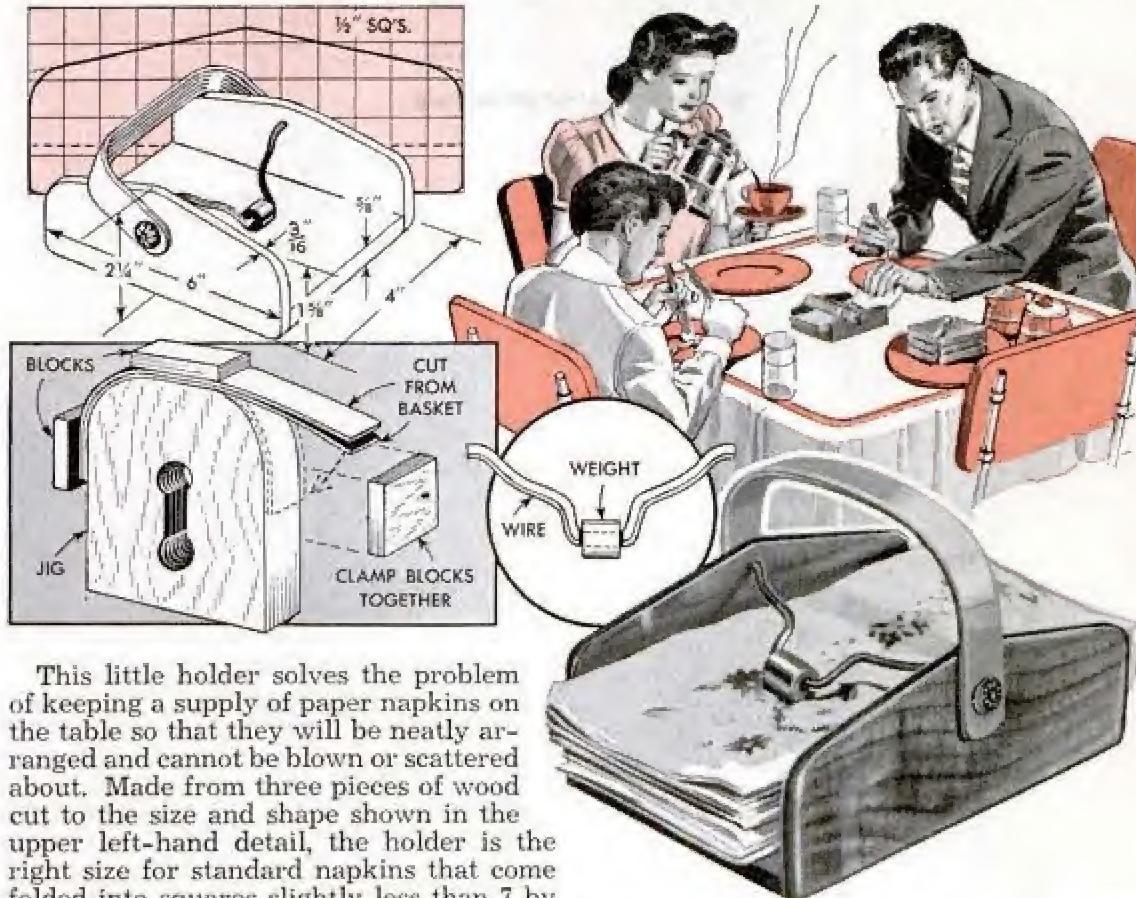
Universal Joint for Light Work Made From Brake-Rod Clevises



Flexible or universal joints for use in light machine drives can be made inexpensively from clevises taken off the ends of old car brake rods. The clevises are heated and bent at right angles at the ends

as indicated, after which they are bolted to a disk of leather taken from an old shoe sole or heavy belt. Usually the shanks of these clevises are threaded to screw onto the rod where they are held by locknuts. They can be attached to your drive shafts in the same way or they can be drilled and tapped for setscrews to lock them in place.

Holder Keeps Paper Napkins Neatly on Table



This little holder solves the problem of keeping a supply of paper napkins on the table so that they will be neatly arranged and cannot be blown or scattered about. Made from three pieces of wood cut to the size and shape shown in the upper left-hand detail, the holder is the right size for standard napkins that come folded into squares slightly less than 7 by 7 in. When the squares again are folded in half they will slip nicely into the holder. It can be nailed or glued together, using nails with ornamental heads to pivot the handle. The latter is made from two splints, each $\frac{5}{8}$ by 8 in., cut from the thin sides of a fruit basket. To shape the splints, soak them in water for a few minutes and then clamp them over a jig made as shown in the lower detail. The jig is cut from a block of wood and has an opening in the center to

take one jaw of a C-clamp. You can use the latter on the upper clamping block and a short bar clamp on the two side blocks. A weight, which rests on the napkins, is held by means of a wire support shaped as shown in the circular detail. The ends of the wire are inserted into holes in the sides of the holder and should fit loosely. Finishing the holder is a matter of choice, using either a wax, varnish or paint.—Charles and Bertram Brownold, Woodmere, N. Y.

Frost Shield Removed Quickly by Using Piece of Thread

Removing automobile frost shields without tearing them or scratching the glass is easy if a piece of strong thread or wire is

worked under them as shown. The corner of the shield is the best place to start the thread under the shield.



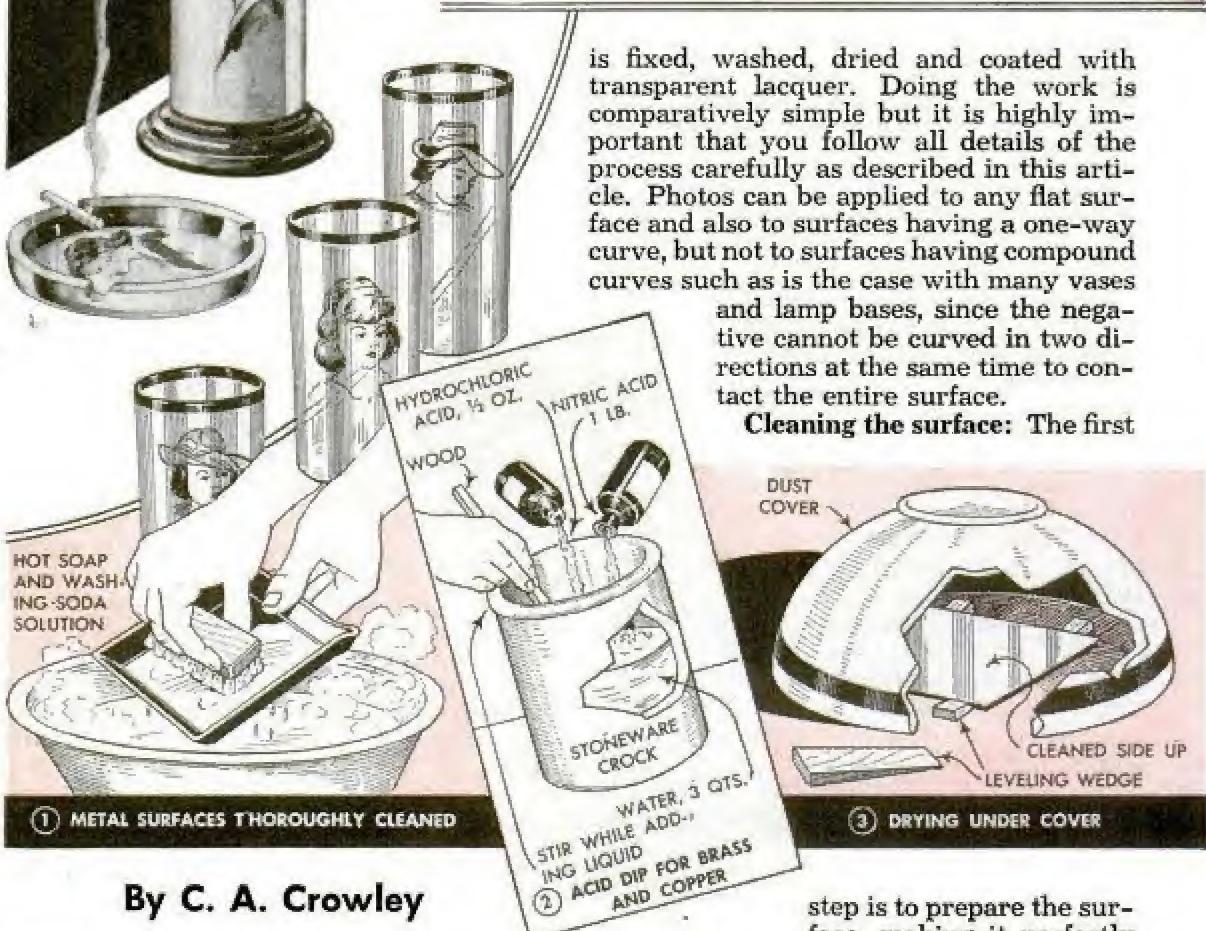
Ready-Mixed Paste for Gravies

When cream gravies or sauces are needed, they can be made more quickly and will be much smoother if the flour-and-water thickening has been prepared beforehand. After the desired quantity of water is placed in a fruit jar, drop the flour in, cover the jar and shake until the paste is smooth.

—Mrs. Kathryn Geihm, Aurora, Ill.



PHOTOS on METAL,



By C. A. Crowley

FOR a lasting and novel display, your favorite photos can be printed on lamp bases, serving trays, beverage glasses, plates, mirrors, wastebaskets and many other items made of non-porous materials. The work can be a fascinating hobby and has possibilities as a profitable spare-time business. All you need is a good negative, preferably one having considerable contrast. This is held in contact with the surface of the material which you have previously cleaned and coated with a gelatin base and a sensitizing solution. Then the exposure is made and the exposed surface

is fixed, washed, dried and coated with transparent lacquer. Doing the work is comparatively simple but it is highly important that you follow all details of the process carefully as described in this article. Photos can be applied to any flat surface and also to surfaces having a one-way curve, but not to surfaces having compound curves such as is the case with many vases and lamp bases, since the negative cannot be curved in two directions at the same time to contact the entire surface.

Cleaning the surface: The first

step is to prepare the surface, making it perfectly clean and free from dirt, grease and corrosion. Metals should be scrubbed in hot soap water containing a few ounces of washing soda per gallon, as shown in Fig. 1. Fine steel wool or other abrasives can be used to aid in cleaning the work while washing it, but these too should be washed off the work with soap and water. The soap water is rinsed away in hot and cold running water. Following this, if there is any rust or corrosion, it must be removed. Brass and copper can be freed from tarnish by dipping in a solution of nitric acid, 1 lb., and hydrochloric acid, $\frac{1}{2}$ oz., in water, 3 qts.,



GLASS and POTTERY

as shown in Fig. 2. The solution is prepared by slowly adding the acid to the water in a stoneware crock, stirring with a glass rod or a wooden paddle while mixing. Aluminum is dipped in a solution of 50 percent hydrofluoric acid, 1 part, and water, 9 parts. A lead or wax-lined container must be used for this solution as hydrofluoric acid attacks glass or stoneware. Or, aluminum can be dipped in a solution of sulphuric acid, 1 lb., and water, 1 qt., to which is added sodium dichromate, 1 oz.

1st—ADD CHROME ALUM
3 GRAINS, IN WARM
WATER, $\frac{1}{2}$ OZ., MIX
WELL

GELATIN, 40
GRAINS,
IN WATER,
1 OZ., HEATED
TO DISSOLVE
GELATIN AFTER
SOAKING

2nd—ADD 10 DROPS
OF A 10% SOLUTION
OF PHENOL



④ PREPARING THE GELATIN MIXTURE

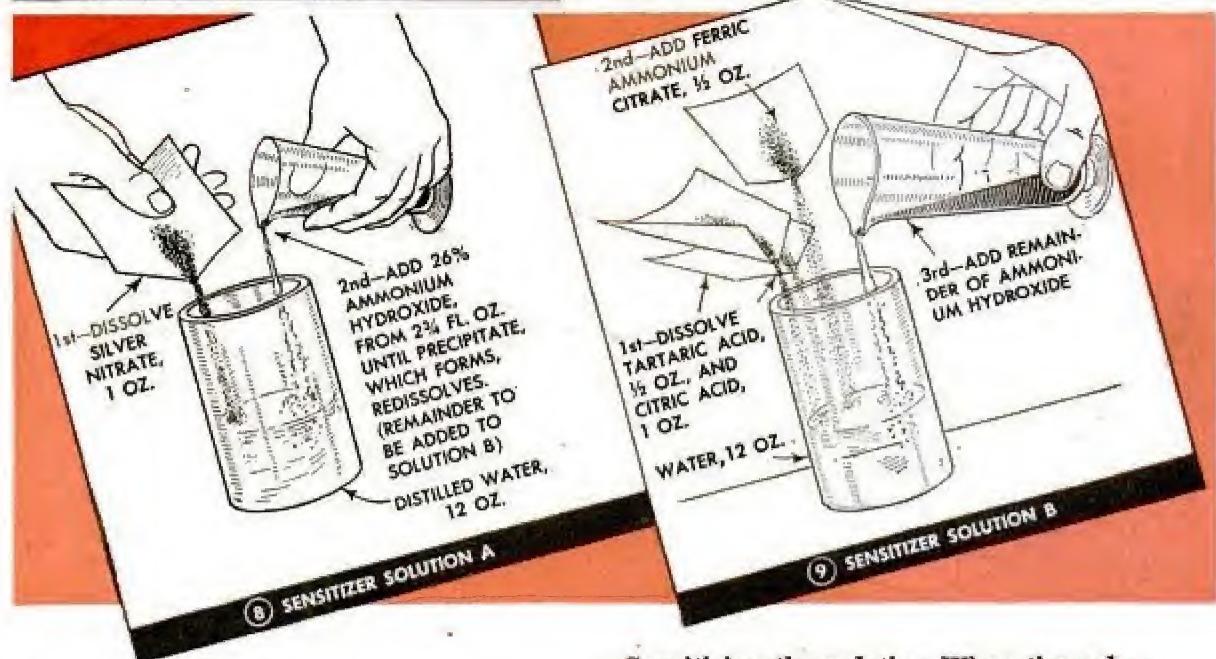
The sulphuric acid is added slowly to the water in a stoneware crock, stirring while adding and, after mixing, the sodium dichromate is added. The metal is dipped in the solution for a few seconds and then rinsed in hot and cold running water. Then it is permitted to dry in air, protected against dust as shown in Fig. 3.

Mixing the gelatin: The surface on which the print is to be made is first coated with a gelatin mixture and later with the sensitizing solution. The gelatin mixture is prepared in two parts. First, put gelatin, 40 grains, in an enameled pan with water, 1 oz., allowing it to soak for about 15 min. While the gelatin is soaking, dissolve in a separate container chrome alum, 3 grains,

in warm water, $\frac{1}{2}$ oz. When the gelatin has soaked, place the pan on a stove and heat gently until the gelatin has dissolved. With the pan still on the burner, add the solution of chrome alum, a few drops at a time, as shown in Fig. 4, while stirring vigorously. When mixing is completed, add about 10 drops of a 10-percent solution of phenol (carbolic acid) and stir. To coat the work, place it face up on a level surface and pour a few drops of the gelatin-chrome-alum mixture on it as shown in Fig. 5. If the surface is not level, wedges should be used as in Fig. 3. The gelatin



7 MASKING PICTURE BEFORE PRINTING



solution should be spread evenly over the surface, using a clean, soft brush as in Fig. 6. The layer of gelatin should be uniform and quite thin. It should be left for at least half an hour or until dry, protected from dust.

Preparing the sensitizer: While the gelatin is drying, the sensitizing solution is prepared in two parts, solution A and solution B. First measure out 2 1/4 fl. oz. of 26-percent ammonium hydroxide, which is the total amount required for both solutions A and B. Chemically pure (C.P.) chemicals and distilled water should be used in preparing the sensitizer. All mixing should be done in glass jars, beakers, or enameled vessels free from chipped

spots or exposed metal. Solution A is prepared, as shown in Fig. 8, by dissolving silver nitrate, 1 oz., in distilled water, about 12 oz., and adding to this solution part of the ammonium hydroxide, drop by drop, until the precipitate which forms at first has redissolved. Solution B is prepared as shown in Fig. 9, by dissolving in a separate container citric acid, 1 oz., and tartaric acid, 1/2 oz., in distilled water, about 12 fl. oz. When this has dissolved, ferric ammonium citrate (green scales) 1/2 oz., is added, and when that has been dissolved, the remainder of the ammonium hydroxide is added to this solution and mixed in.

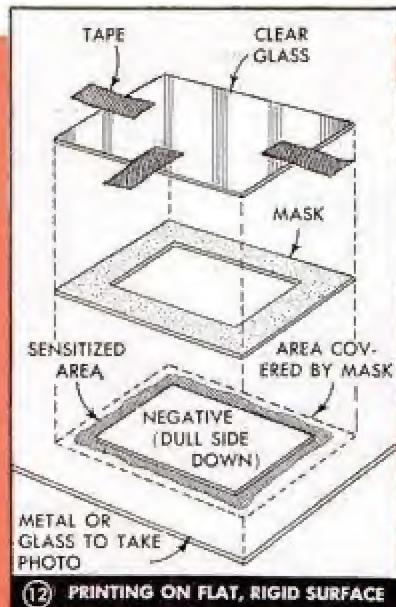
The sensitizer is ready for use after solution A has been added to solution B, and stirred to mix well. This must be done in a subdued light. Enough distilled water is added to bring the total volume of sensitizer to 1 qt., and it should be stored in a brown bottle, tightly corked.

Sensitizing the gelatin: When the gelatin film on the work has hardened you are ready to sensitize it. Lay it, gelatin side up, on a level surface, or level it with wedges, and pour on a few drops of the sensitizing solution. Then brush the solution over the entire surface evenly with a soft camel's-hair brush. In working with the sensitizer avoid exposing it to sunlight or artificial light—keep it in subdued, reflected light although it is not necessary to use a photographic darkroom. The sensitized sheet should be set away, protected against dust and light, until it has had time to dry, which will take at least half an hour.

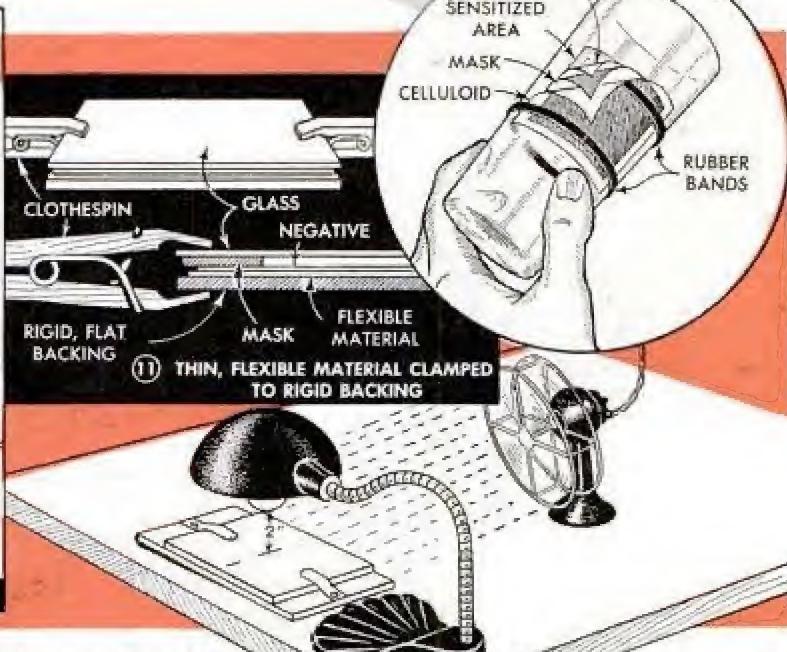
Exposure: Prints can be made from any good negative, although a contrasty negative will give the best results. The negative

should be placed with its dull or emulsion side in contact with the sensitized surface (working in subdued light) and a suitable mask placed around the part to be printed as shown in Fig. 7. All or any part of the negative can be used. Masks can be cut in any desired size and shape from lightproof paper or cardboard. A clean piece of glass or celluloid should be placed over the mask to hold the negative in contact with the sensitized surface, Fig. 12. On flexible material, the glass is clamped to it with paper clips or spring-type clothespins as in Fig. 11, a flat, rigid backing being provided. On curved surfaces, the mask and negative are placed under a piece of celluloid, or Cellophane, which is held on the work by rubber bands or cellulose tape as in Fig. 10.

The exposure can be made either by direct sunlight or a photoflood lamp. Usually exposure requires from 2 to 5 min., de-



(12) PRINTING ON FLAT, RIGID SURFACE



pending on the density of the negative. If you use a photoflood lamp it can be put in a standard reflector or in a desk lamp as in Fig. 13. On small negatives, the lamp should be placed about 2 in. from the glass. For larger negatives the lamp should be raised so all parts of the negative are about the same distance from the lamp. A fan is placed as shown to prevent overheating.

Fixing and finishing: No development is required, but the print must be fixed for 30 sec. in a solution of sodium thiosulphate (hypo), 2 oz., in water, 1 qt., used at a temperature not over 65 deg. F. After fixing the print it is rinsed in cold water. Then the gelatin should be given a final hardening by immersing the print for 30 sec. in a solution of 40-percent formaldehyde, 1 part, and water, 10 parts, at a temperature



HOW TO PRINT
ON CURVED
SURFACES

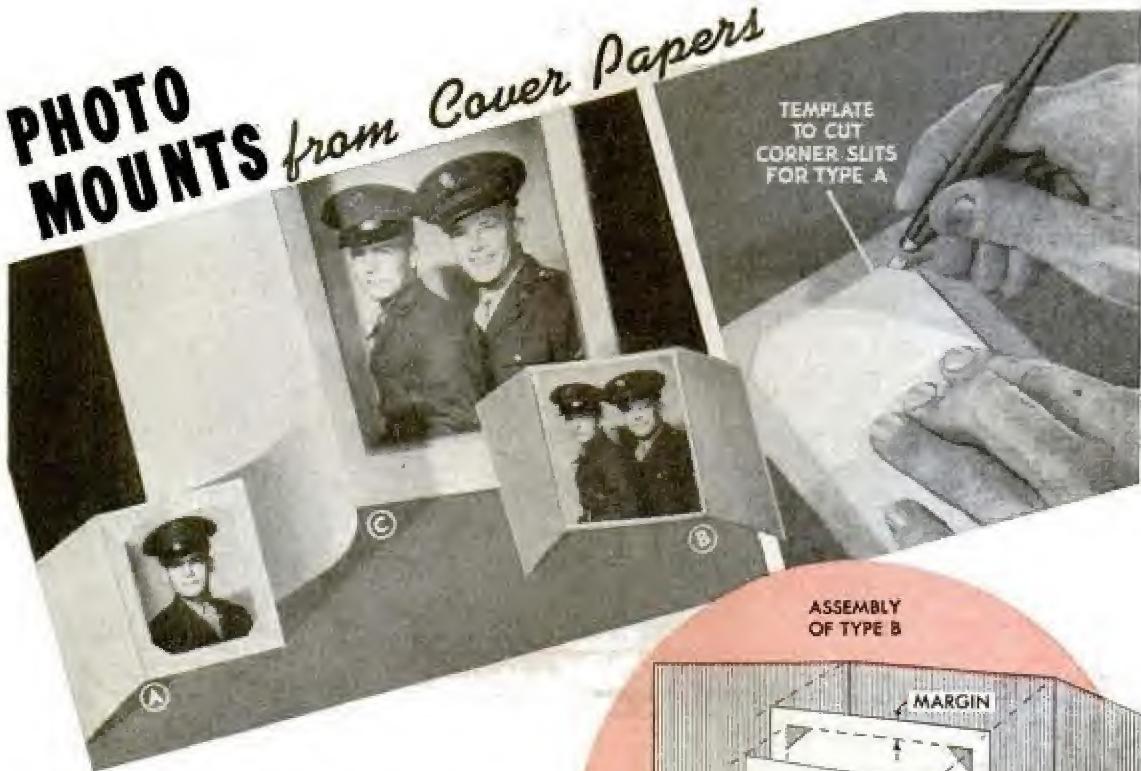
(13) EXPOSING BY PHOTOFLOOD LAMP

not over 65 deg. F. The finished print is rinsed again in cold water and allowed to dry. Transparent lacquer applied on the finished work protects it from scratches.

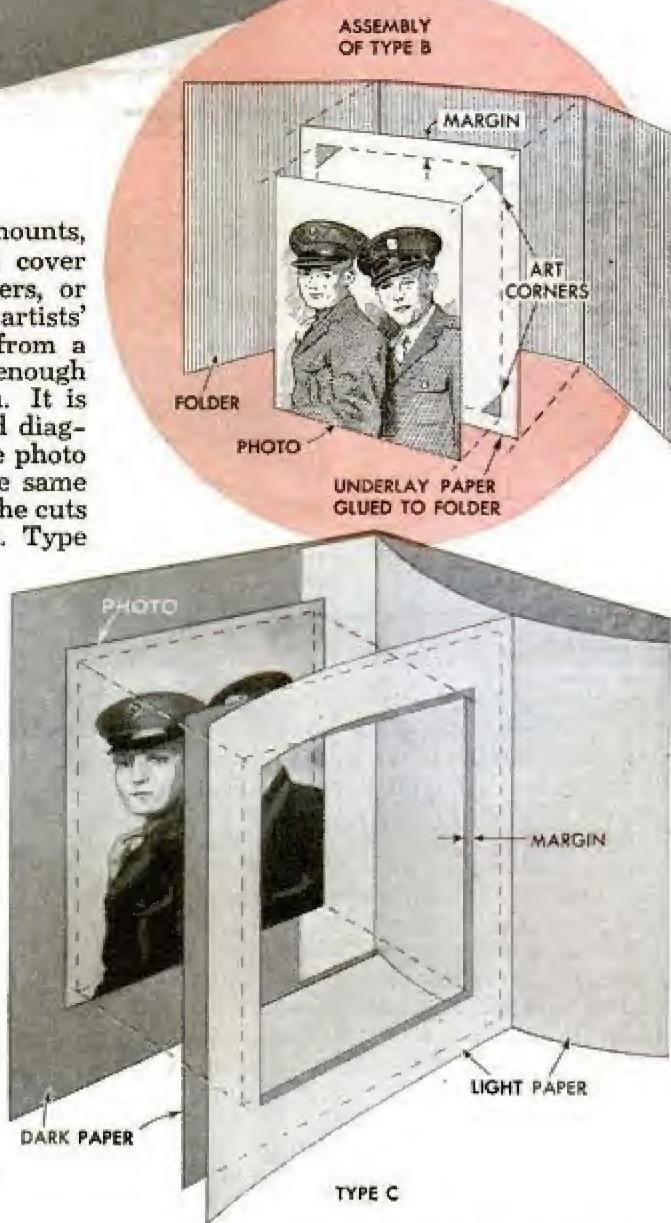
Show-Card Black for Lettering On Glossy Prints

For lettering captions or other notations on glossy prints, show-card black is better than waterproof ink, which eventually will crack off. Mix the show-card black with a little very soapy water which acts as a binder, and load the pen with a brush. This mixture will adhere also to china and glass, and may be wiped off with a damp swab.

PHOTO MOUNTS from Cover Papers



IN THE absence of suitable photo mounts, you can make your own from cover paper, usually obtainable at printers, or other heavy paper purchased from artists' supply houses. Type A is made from a single sheet of stock which is stiff enough to support photos up to 4 by 5 in. It is scored at the center for folding and diagonal corner slits are cut to hold the photo in place. A cardboard template the same size as the photo facilitates making the cuts the right size in the correct position. Type B consists of a large sheet of cover paper folded twice to provide a back and two wings. Fold the left wing so it will overlap the other when closed. With this mount, art corners are used to hold the photo. They are pasted to a sheet of contrasting paper cut $\frac{1}{4}$ in. larger than the photo to form an underlay and to help stiffen the mount. For large photos, use a mount such as type C. Besides the folded back and a flyleaf, it has two masks over the photo, one of dark and the other of light paper. The opening in the dark mask is cut slightly smaller than the one in the light mask. The top mask should match the flyleaf. To assemble the mount, first glue in the flyleaf and then the photo, following with the masks, which first are glued together and then attached over the photo.



Side-and-Back Lighting Gives Portraits Depth

With this arrangement of side lighting you get just the opposite light-and-shadow effects from those obtained with the usual setup of lights directed at the subject from the front. Well rounded contours that result are especially pleasing for portrait work as they have a three-dimensional effect. Sides of the face receding farthest from the camera are lighted, the outline of the head and shoulders is brought out to separate the subject from the background and the parts of the face closest to the camera are slightly toned down in shadow. Also, the hair is highlighted, which gives it life and snap. Three photofloods of equal intensity are used. Two are set at equal distances from the subject, one on each side and slightly behind it so that the light is directed downward at about a 45-deg. angle. The third lamp is placed slightly on one side, ahead of and a little above the camera. Its distance from the subject should be about one-third greater than that of the other two lamps, or at a point where the face shadow is softened sufficiently. By moving it farther away you can deepen the "tone" or "mood" of the picture for special effect, but if you place it too far away the shadow on the face will be too dark. Moving it too close, however, will tend to "flat-



ten" the picture by equalizing all three lights. Always use a lens shade, of course, to avoid direct glare into the lens. This arrangement of lamps can be used for home movies because no matter where the actors are, the light will reach all surfaces in about the same proportions.

—Skippy Adelman, New York.

Handle Small Prints With Spatula to Avoid Fingerprints



Use of a kitchen spatula for handling small prints while developing eliminates the danger of fingerprints and other handling stains. It is also handy to lift the print closer to the safelight for inspection. If a stainless steel spatula is used, there will be no danger of corrosion.

We pay cash for ideas showing simpler and better ways to do daily tasks, shortcuts in shop work, dark-room aids, household hints, auto kinks, etc. Send a good photo or sketch and a concise but full explanation of your ideas to the Homecraft Editor, Popular Mechanics, 200 East Ontario Street, Chicago 11, Ill.

CRAFT QUIZ ~



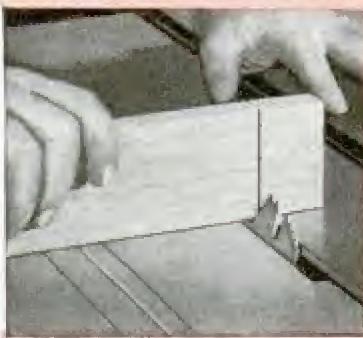
1. Bolts on wood trailer bed are—
(a) Hanger bolts (c) Toggle bolts
(b) Bed bolts (d) Carriage bolts



2. This wood turner is using a—
(a) Gouge (c) Parting tool
(b) Skew (d) Spear



3. This wall finish is known as—
(a) Hen tracks (c) Tiffany
(b) Antique (d) Sponge mottle



4. You can see this saw has a—
(a) Swing cut-off (c) Rip fence
(b) Tilting arbor (d) Dado head



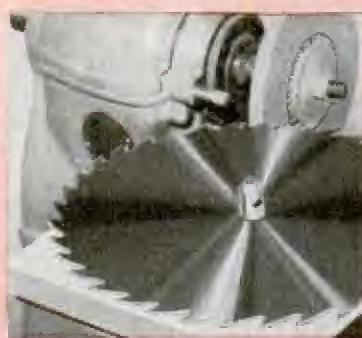
5. Good wood to plank this boat is—
(a) Red gum (c) Red oak
(b) White pine (d) Chestnut



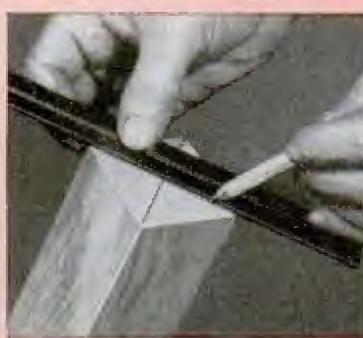
6. For glass grinding you use—
 (a) Garnet (c) Pumice
 (b) Silicon carbide (d) Flint



7. Wood is being prepared for a—
 (a) Dowel joint (c) Butt joint
 (b) Miter joint (d) Scarf joint



B. This circular saw is a—
(a) Planer (c) Miter
(b) Crosscut (d) Rip



9. Getting ready to use o—
(a) Bond saw (c) Sander
(b) Jointer (d) Lathe

ANSWERS: 1-d; 2-b; 3-a;
4-b (table is round, blue
tiled—hence tilting problem);
5-b (white pine woods or
rots later of these woods);
6-b; 7-c (inlier used to
get straight and square
edges); 8-d; 9-d (end of
wood is bearing center
marked); 10-e (perenni-
nals, 1/2 in. long); 11-a



10. Size nails for this job are—
 (a) 10-penny (c) 4-penny
 (b) 6-penny (d) 7-penny



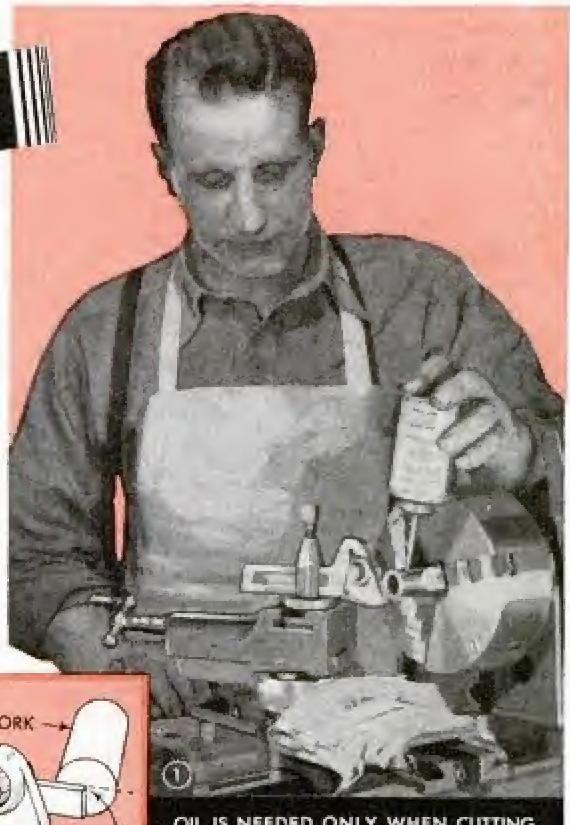


SHOP NOTES

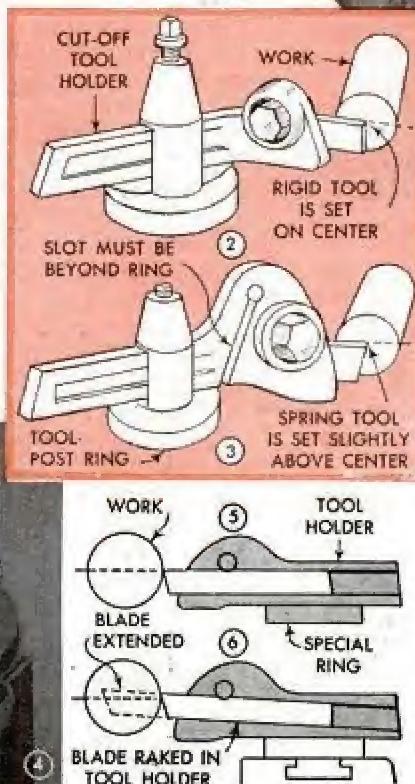
Tricks of **CUTTING-OFF** in the lathe

By Sam Brown

THE cut-off tool is a narrow, ready-shaped blade which requires only grinding of end clearance to keep it sharp and ready for work. It is held in a cut-off tool holder. There are two common types of tool holders—rigid and spring. The rigid type is always used with the blade set on the centerline of the work as shown in Fig. 2. With the spring type the blade is set slightly above the center of the work as in Fig. 3. Of the two, the spring type is slightly more expensive, but it is far superior for all general cutting and it is the only type that works well with a power feed. Both rigid and spring types of tool holders can be obtained in straight, right offset and left offset pat-



OIL IS NEEDED ONLY WHEN CUTTING TOUGH, HARD STEEL. MILD STEEL AND ALL OTHER MATERIALS CAN BE CUT DRY



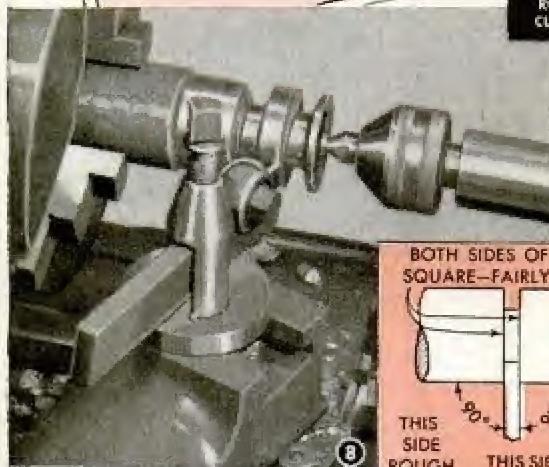
terns. The right offset pattern is most generally used as it can work closer to the chuck than either of the others. Since the tool is always used in a fixed relation to the centerline of the work it is a good idea to use a special toolpost ring as shown in Fig. 4, to automatically support the blade at the right height. This arrangement works with the blade at any extension if the blade is parallel with the tool holder, as shown in Fig. 5. If the blade is set at an angle or "raked" in the tool holder as in Fig. 6, the ring should be made up for a 1-in. extension



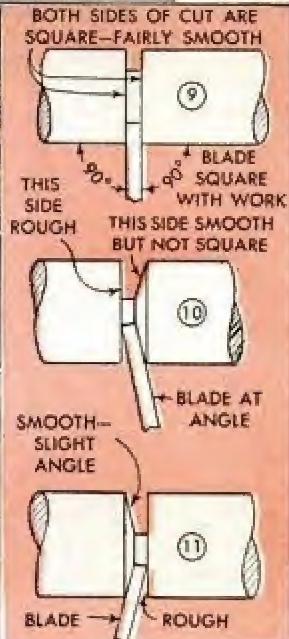
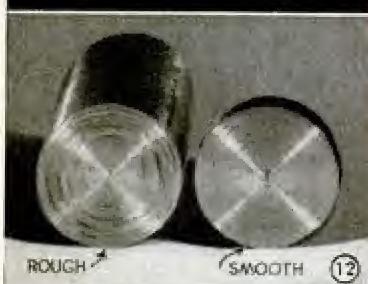
What speeds
and feeds are
best?

The table at the right shows what will happen when the cut-off tool is used on medium hard steel at various speed-feed combinations.

7 IF YOUR LATHE DOES NOT HAVE POWER FEED, APPLY THIS FORMULA:
 $6 \div (\text{WORK SPEED IN R.P.M. TIMES FEED})$
 THE RESULT IS TIME IN SECONDS FOR ONE COMPLETE REVOLUTION OF FEED HANDLE
 EXAMPLE:
 WORK SPEED = 150 R.P.M.
 FEED PER REV. = .002 IN.
 $150 \times .002 = .3$
 $6 \div .3 = 20 \text{ SECONDS}$



The blade will cut rough or smooth, depending on angle it is fed to work



CUTTING IS POSSIBLE IN THIS RANGE BEST FEEDS AND SPEEDS FOR GENERAL WORK

NOT SATISFACTORY CUT CANNOT BE MADE TIME IN MINUTES TO CUT 1-IN. DIAMETER BAR

TEST CUTS IN MEDIUM HARD STEEL Table No. 1

Feed Per Rev.	SPINDLE SPEED				
	50 R.P.M. 13 S.F.M.	100 R.P.M. 13 S.F.M.	150 R.P.M. 40 S.F.M.	300 R.P.M. 80 S.F.M.	500 R.P.M. 130 S.F.M.
.0002	Rub	50	Rub	25	Squeal
.0004	Too Slow	25	Slow	12.5	Slow
.0005	Slow	20	Slow	10	Slow
.0010	Slow	10	Slow	5	Chatter
.0014	Slow	7.1		3.5	Good
.0018	Slow	5.5		2.7	Good
.0021	Slow	4.7	Good	2.4	Good
.0024	Slow	4.2	Good	2.1	Good
.0027		3.7	Good	1.8	Good
.0031		3.2	Good	1.6	Good
.0036		2.8	Good	1.4	
.0043		2.3	Good	1.2	
.0050		2.0		1.0	Grunt
.0072		1.4	Near Max.	.7	Near Max.
.0100	Near Max.	1.0	Near Stall	.5	Stall

D.K. BUT SLOW AND ROUGH CUTTING

GOOD RANGE. EXCELLENT SPEED FOR HARD STEEL

BEST CONSTANT SPEED FOR GENERAL WORK

FASTEAST. BLADE CUTS BEST WITH BACK RAKE

VERY CRITICAL AS TO FEED AT THIS SPEED

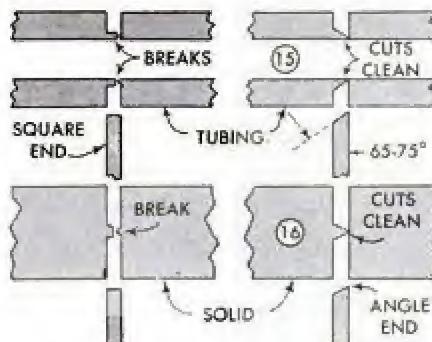
of the blade in which case the blade always should be used at this extension. It can be seen from Fig. 6 that if the blade is pushed out farther it will be above the centerline of the work.

Speed and feed: By a careful study of Table No. 1 on test cuts in medium hard steel, you can determine what will happen when the cut-off tool is used at various speed-feed combinations. Note that as the spindle speed is increased, the feed rate becomes more critical. Hence, if you use the hand feed, the lower speeds are best. However, at the very low speed of 50 r.p.m., the operation is slower than hack-sawing. Picking up a chip and holding it with a steady feed is the secret of cutting-off. General fault is too slow a feed, which should be at least .0015 in. per rev. in order to hold a chip in steel with a straight blade as shown in Fig. 13. If your lathe does not have a power crossfeed, use the formula given in Fig. 7 to determine time required. This will tell you how fast to turn the cross-

slide handle to get a specific feed per rev. A little practice with a watch in view will enable you to approximate any given feed.

Feed angle of blade: This should be straight in as shown in Fig. 9. If you are making a cut at an angle, as for example in making a pulley, the tool holder must be mounted perfectly square with the compound and fed with the compound handle as in Fig. 8. If the blade is not square with the work, it will cut one side rough and the other side smooth, as shown in Figs. 10, 11 and 12. In cases where a slight angle does not matter, this kind of cut can be used to advantage occasionally in order to produce a smooth surface.

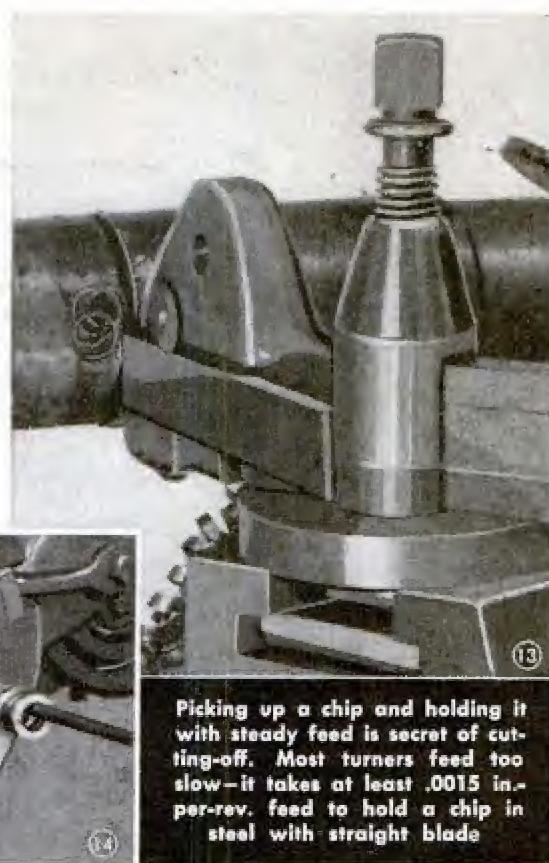
Chatter and "hogging": Chatter is caused by the inability of the cutter to penetrate



Picking up a chip and holding it with steady feed is secret of cutting-off. Most turners feed too slow—it takes at least .0015 in.-per-rev. feed to hold a chip in steel with straight blade

the work and hold the chip. A fine feed will cause chatter because the blade does not penetrate. If the blade does not have back rake, it takes a minimum of about .015 in. to pick up and hold a chip. On hard steel and hard brass, chatter is present at all feeds if a straight blade is used. Therefore the remedy here is to use a blade with back rake. This permits easier penetration and holds a chip at a slower feed rate than is the case with a straight blade. "Hogging" occurs when the feed is too heavy—when you try to take a chip that is too much for the lathe or the tool—with the result that the lathe stalls, the work twists out of the chuck, or the tool breaks.

Large work: Maximum diameter for cut-off work on a small lathe is about 3 in. Do not project the blade the full distance at the start, but work it out gradually, a quarter of an inch at a time. Cutting a double groove in order to obtain more clearance is good practice generally followed in making deep cuts. All cuts made in hard and also in mild steel that has a diameter greater than 1 in. should be given a lib-

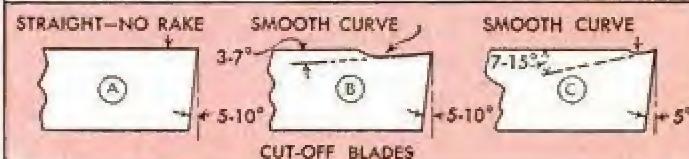


RECOMMENDATIONS FOR CUT-OFF WORK Table No. 2

Material	Nature of Chip	Work Speed in R.P.M.*	Tool Feed Per Rev.	Blade
Mild Steel	Short Curl	250	.0025	A or B
Medium Steel	Medium Curl	150	.0025	A or B
Hard Steel	Stringy	100**	.002	B or C
Yellow Brass	Short-Brittle	500	.0015	A
Hard Brass	Stringy	300	.002	B or C
Bronze (Phosphor)	Stringy	300	.002	C
Cast Iron	Short Chips	150	.002	A or B
Cast Plastics	Long Ribbon	500	.002	A or B
Copper	Stringy	300	.0015	B or C
Aluminum	Medium Curl	500	.0015	C

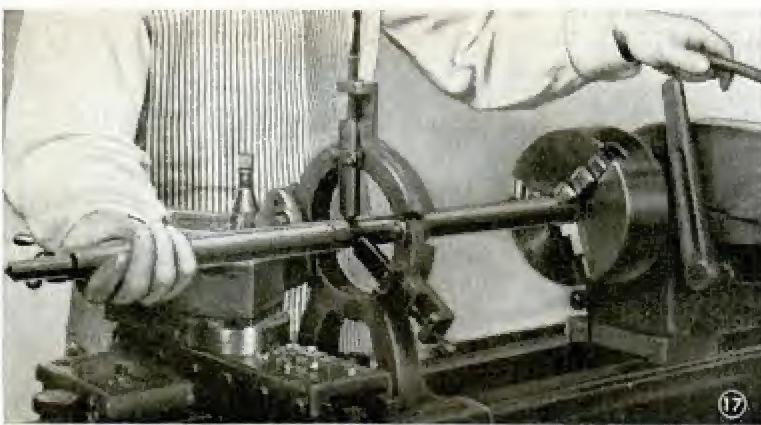
* Constant speed—Use for all work up to 1½" diameter

** Use cutting oil (lard oil) especially on diameters over 1"



eral application of cutting oil as in Fig. 1.

Special setups: When you are cutting washers it is a good idea to fit a small rod inside the hole to catch the finished work as it is cut free, as shown in Fig. 14. When cutting-off in the center of a bar, always support the work at the point of cutting with a steady rest as in Fig. 17, and cradle the free end in your hand. All cuts over 3 in. from the chuck should be supported



by bringing up the tail center; after which the stock is turned to not less than $\frac{1}{4}$ in. diameter. Then the work is removed from the lathe and the $\frac{1}{4}$ -in. neck is parted with

a hacksaw. If you want to eliminate the small nib, which forms when work is cut off with a standard straight-end blade, use a blade ground at 65 to 75° angle as shown in Figs. 15 and 16.

Various metals: Recommendations for cutting off various metals are given in Table No. 2. Use the constant speed system specified and you will quickly get the feel of the work. You should have

three cut-off blades, as shown in details A, B and C below Table 2. When you have trouble with any cut, reduce the spindle speed but maintain the feed.

Interchangeable Soldering-Iron Heads Shaped to Suit Job

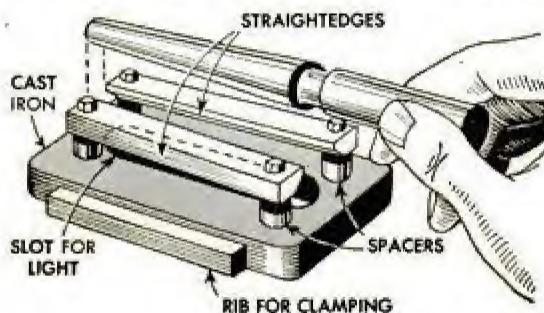
Anyone who has considerable light soldering work to do, such as radio repairing, will find interchangeable soldering-iron heads of copper like the ones shown very convenient. Besides these heads, others can be made to suit your particular needs. They can be of irregular shape to get into hard-to-reach places, or they can have two soldering points for soldering in two positions at the same time. However, the heads should not be too long or too slender if a soldering temperature is to be maintained at the ends. In preparing a soldering iron for the interchangeable heads, unscrew the original head and slot it as indicated. Then drill and tap a hole through the head from opposite sides of the slot for a retaining screw to hold the interchangeable heads in place. If possible, it is a good idea to obtain another head like the original one for the iron so that it can be used for heavy work whenever necessary.



Adjustable Gauge for Testing Tapers Has Many Uses in the Shop

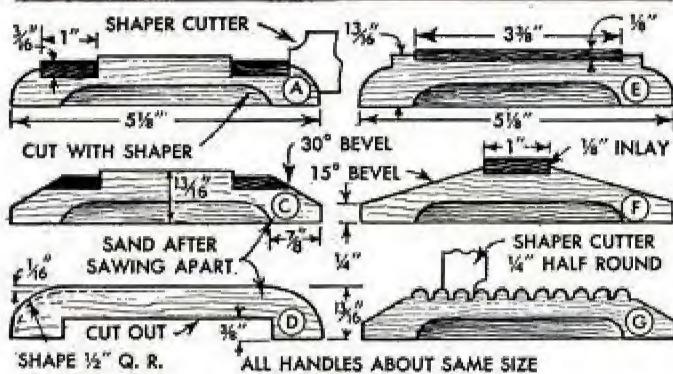
Machinists will find this gauge a time-saver when making or checking tapers, drills, reamers, etc. Also, auto mechanics will find it handy as a go-and-not-go gauge for straight cylindrical work. The gauge

consists of two adjustable straightedges mounted on a cast-iron base, which has a rib on one side for holding or clamping the gauge when in use. The straightedges are made of tool steel hardened and ground, and their testing faces are lapped flat and straight to very close limits. They can be adjusted to any standard taper. An opening milled in the base admits light.



Often slight perspiration on the hands will cause rusting of polished steel. If you experience this trouble, rub your fingers lightly on the back of your head before handling precision steel tools. Natural oils transferred to the fingers in this manner will prevent the trouble.

Strip-Cut DRAWER PULLS



INSTEAD of making drawer pulls individually, when several identical ones are required, use the strip-cut method in which one strip of wood is machined to shape and then cut into strips representing completed pulls. This assures uniformity in shape and saves time by eliminating repeated machine operations. Designs other than those shown can be devised to suit individual requirements. Waterproof glue should be used to secure the inlays, otherwise they may loosen when exposed to dampness.

Basket Under Inspector's Stool Keeps Cleaning Cloths Handy

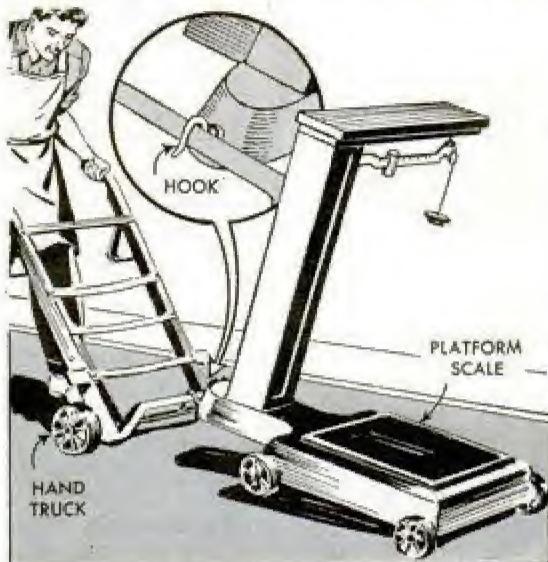


In the inspection department of one war plant it was found that a basket-like receptacle under the inspector's stool provided a handy place to keep cleaning cloths. Made of wire mesh, the basket is attached between the upper rungs of the stool where it is out of the way, yet is within easy reach of the worker.

—Kenneth Murray, Baltimore, Md.

Platform Scales Moved About Easily With Hand Truck

The difficulty of moving platform scales to the various locations necessary in his store, especially through narrow spaces and around corners, led one produce buyer to attach a hook to the front end of the



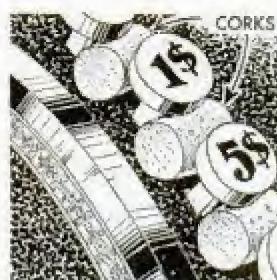
scales as shown. With this arrangement, the beak of a hand truck could be used to lift the front of the scales and tow them wherever needed.

Hay-Rope Hole in Wall of Barn Reinforced With Horseshoe

Splitting and damaging of boards on a barn where an opening is cut for the passage of a hay rope may be avoided by reinforcing the opening with a horseshoe. In this way, wear caused by the rope swinging to one side or the other will be taken by the metal shoe, which also will prevent the board from splitting under strain of the rope pressing against it. Edges of the shoe should be rounded where they touch the rope.



Avoiding Errors on Cash Register



In one drug store where inexperienced clerks at the fountain often made errors by pressing the keys denoting one dollar or more, these keys were locked by pushing small corks between them as indicated. Since individual purchases rarely amounted to a dollar, use of these keys was not required, and locking them made it impossible for errors of more than a dollar to be made.

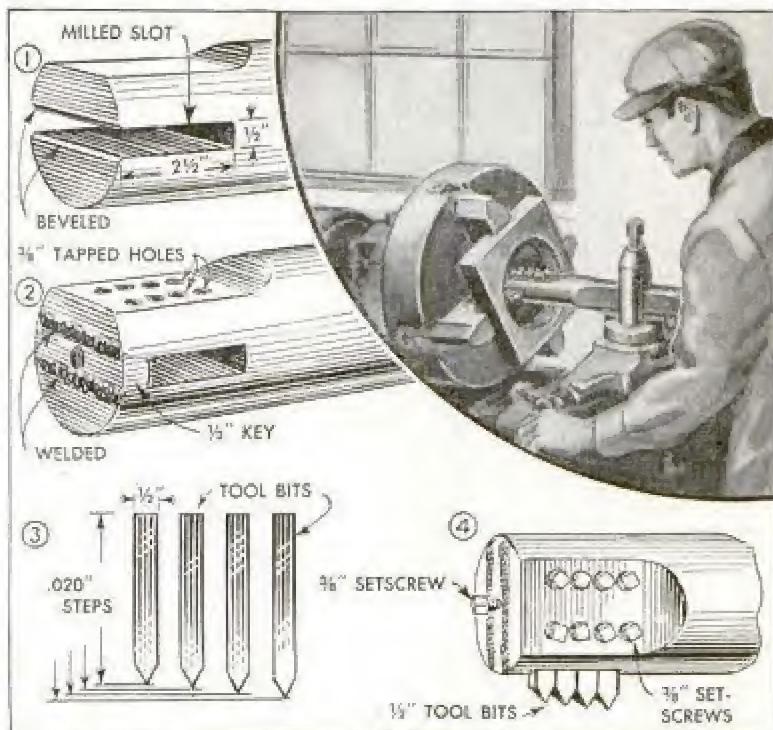
Self-Supporting Display Cards

To avoid the use of special blocks or stands to support large display cards on the floor, one card writer uses double cards as indicated. The cards are bent to a slight arc and stapled together with a piece of cardboard between them. The cardboard holds the cards in the bowed position, thus spreading them at the bottom so that they will stand alone.



Multiple Tool Bits Cut Threads in One Operation

With this tool, much time can be saved when threading large nuts as the thread can be completed in one operation. The tool consists of a holder shaped as shown and slotted at one end to hold four $\frac{1}{2}$ -in. tool bits. After the slot has been milled, the flattened portion of the holder is drilled and tapped for eight setscrews which hold the tool bits in position. As a further aid in keeping the bits in correct alignment, the slot is plugged with a piece welded in place and fitted with a setscrew to exert end pressure against the bits. These are adjusted so that the cutting ends project .020 in. progressively toward the back.

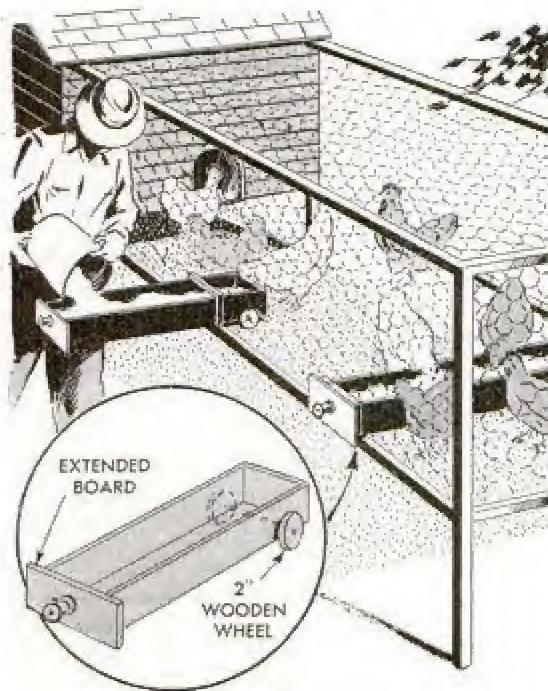


Wheeled Feed Boxes Simplify Care of Housed Chickens

Caring for chickens housed in coops is simplified with feed boxes like the one shown. It has small wheels at one end and can be pulled out for filling without opening a door through which chickens might escape. The boxes are made like drawers with the front ends projecting beyond the

sides so they cannot be accidentally pushed beyond the openings in the coop sides. Wheels 2 in. in diameter are attached to the rear ends on nail axles and rest on the bottoms of the coops.

—L. D. Mooty, San Antonio, Tex.



Bluing Polished Steel Screws

For bluing polished steel screws, heat them in sand until they take on the characteristic oxide blue due to temperature, after which they are quenched in linseed or mineral oil. To obtain a deeper blue shade, dip the screws in lubricating oil and burn the oil off by placing the screws on a thin steel plate over a gas flame. When the first coating of oil has been burned off, more can be sprayed on giving an even deeper color, while still more oil should be applied as the screws are cooling.

Clean Bearings in Light Oil

Bearings are cleaned best by soaking them in a light oil heated to about 175° F. If time is limited, a commercial cleaning fluid may be used if care is taken to lubricate the bearings thoroughly after cleaning. Although gasoline often is used for the purpose, most of the gasolines carry anti-knock compounds which are injurious to bearings.



RULES FOR SAFE TRACTOR OPERATION

1. Be sure the gear shift lever is in neutral before cranking the engine.
2. Always engage the clutch gently, especially when going up a hill or pulling out of a ditch.
3. When driving on highways, or to and from fields, be sure that both wheels are braked simultaneously when making an emergency stop.
4. Always ride on seat or stand on platform of tractor. Never ride on drawbar or drawn implement.
5. When tractor is hitched to a stump or heavy load, always hitch to drawbar and never take up the slack of chain with a jerk.
6. Be extra careful when working on hillsides. Watch out for holes or ditches into which a wheel may drop and cause tractor to overturn.
7. Always keep tractor in gear when going down steep hills or grades.
8. Always drive tractor at speeds slow enough to insure safety, especially over rough ground or near ditches.
9. Reduce speed before making a turn or applying brakes. The hazard of overturning the tractor increases four times when speed is doubled.
10. Always stop power take-off before dismounting from tractor.
11. Never dismount from tractor when it is in motion. Wait until it stops.
12. Never permit persons other than the driver to ride on tractor when it is in operation.
13. Never stand between tractor and drawn implement when hitching. Use an iron hook to handle drawbar.
14. Do not put on or remove belt from belt pulley while the pulley is in motion.
15. Should motor overheat, be careful when refilling radiator.
16. Never refuel tractor while motor is running or extremely hot.
17. When tractor is attached to a power implement be sure that all power-line shielding is in place.

(Prepared by the Farm Safety Committee of the Farm Equipment Institute and approved by the National Safety Council)

Keep Your

To keep a tractor in good condition, it's the daily service routine that counts. Careful attention to the simplest service details helps to cut down the big repair bills and is certain to result in much longer periods of peak efficiency and trouble-free service



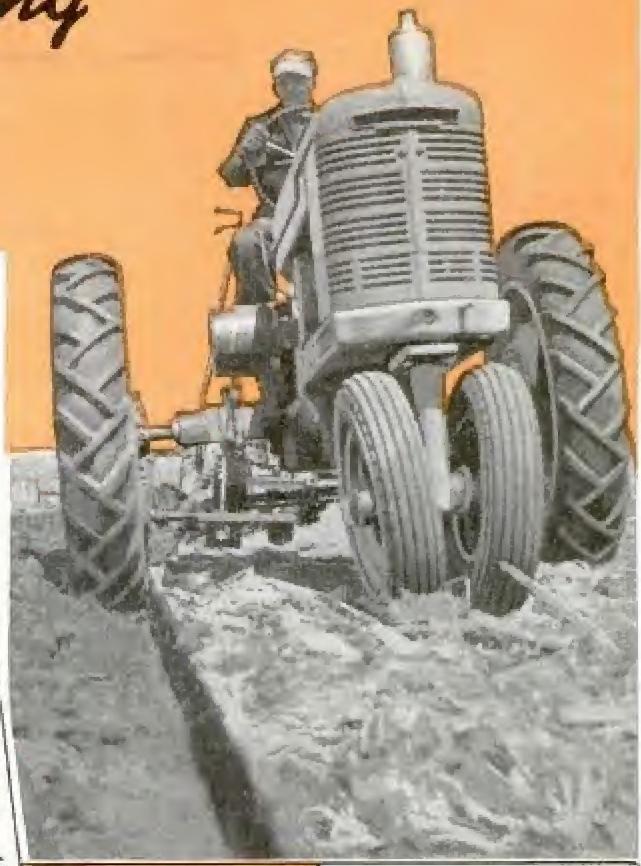
By W. Clyde Lammey

YOU DON'T have to be an experienced mechanic to do the simple service jobs recommended by the manufacturer of your tractor. The important thing is to make sure that a maintenance schedule is carried out day in and day out. This schedule must include all parts that require periodic attention. It won't do to check fuel, oil, water, air pressure in the tires, grease daily, and then, for example, neglect to service the air cleaner or check the level of the battery solution at the proper time. It's a good idea to keep written records of service on those parts that require attention over longer periods of time.

Fig. 1 gives a maintenance schedule, which, of course, does not agree in every detail with recommendations by various manufacturers, due to the varying designs of tractors and parts, but it does show the importance of attention at regular intervals. Equal in importance to the regular schedule of maintenance is periodic attention to the proper condition of the six parts shown in Fig. 2. Neglect of any one of these will cause a waste of fuel and oil, which will result in undue wear and unsatisfactory operation of the tractor within a comparatively short time. The operator who fails to clean and grease the magneto or distributor at the proper time, add distilled

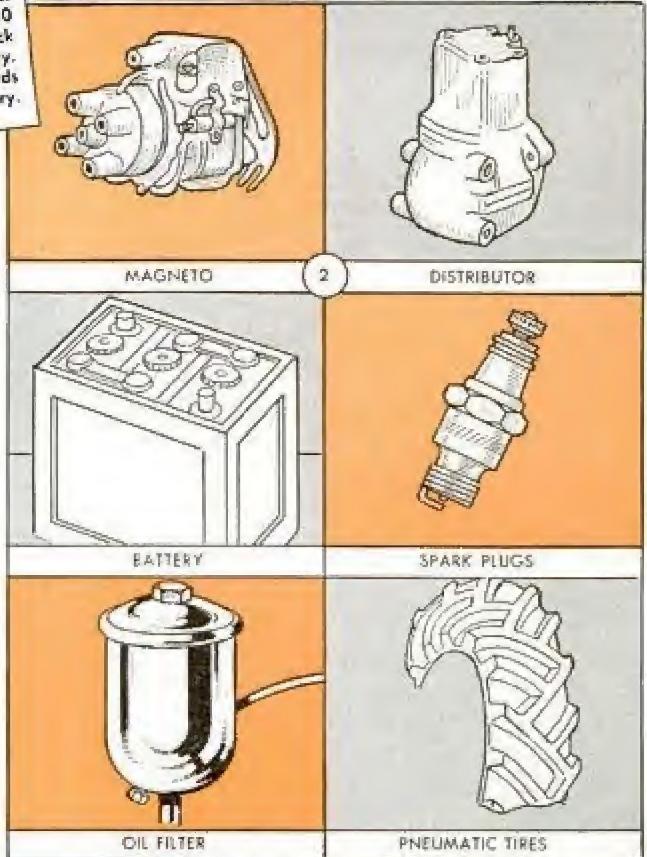
Tractor Rolling

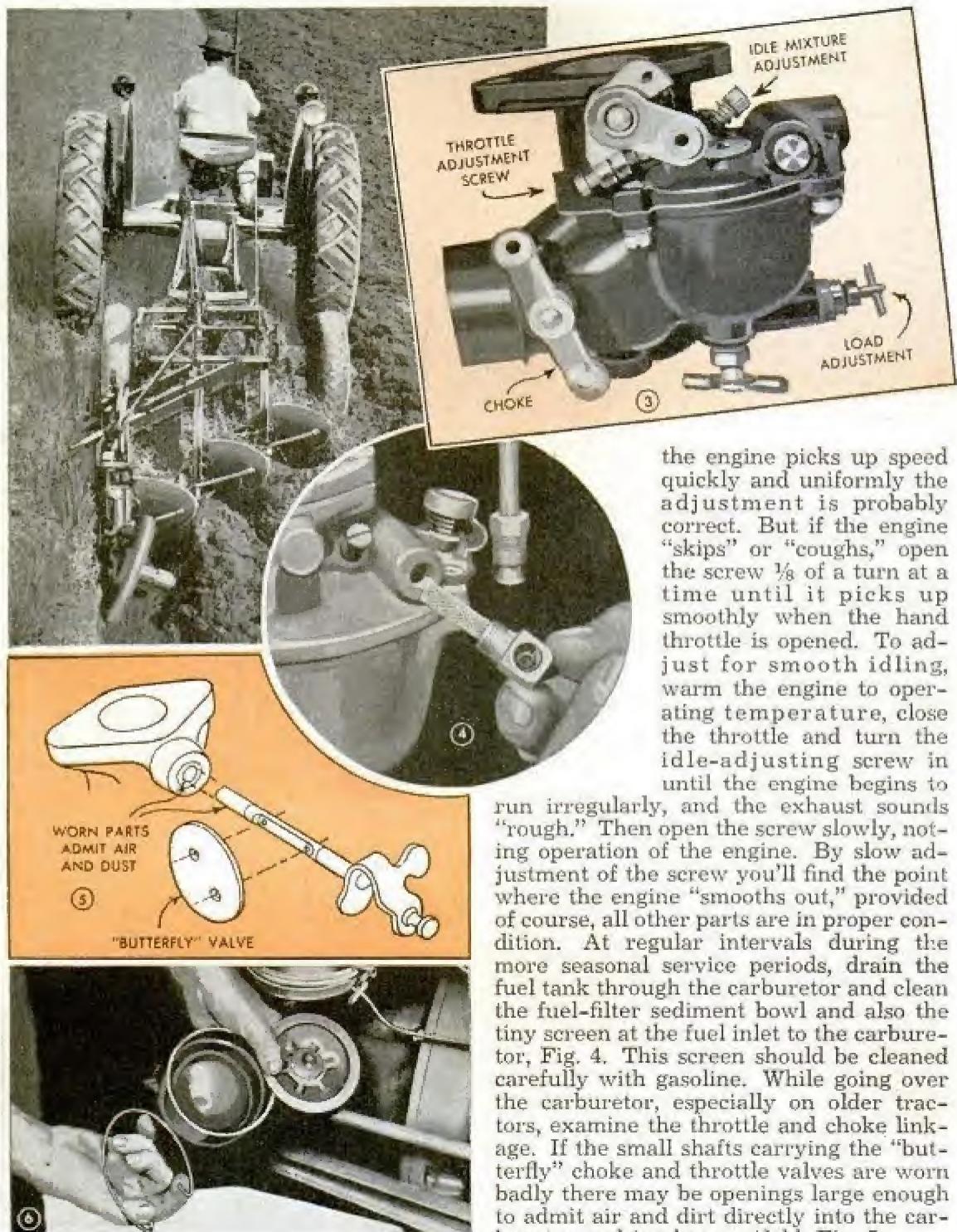
- (1) **EVERY 10 HOURS**
1. Air Cleaner—wash and refill oil reservoir. Clean top screen.
 2. Lubricate—grease fittings.
 3. Crankcase—check oil level.
 4. Cooling System—check water and antifreeze.
 5. Breather Cap—wash in gasoline or clean as recommended in instruction manual.
 6. Fuel Filter—inspect and clean if necessary.
 7. Tire Pressures—inflate to proper pressure.
- EVERY 20 TO 60 HOURS**
1. Battery—wipe away dust, check solution level, add distilled water when required. Coat terminals with vaseline if necessary.
 2. Front Wheel Bearings—lubricate with grease gun if provided with pressure grease fittings.
 3. Bolts and Nuts—check with wrench every 60 hours for tightness.
 4. Radiator—inspect and clean out dirt and chaff.
- EVERY 100 TO 600 HOURS**
1. Transmission and Differential—change gear oil in new tractor after 200 hours; then every 600 hours. Use oil of recommended viscosity.
 2. Crankcase Oil—change of 200 hours or under if oil shows dark on dipstick. Use oil of recommended viscosity.
 3. Oil Filter— renew cartridge when oil is changed.
 4. Front Wheel Bearings—(not equipped with grease fittings) pack with proper grease and adjust bearings.
 5. Generator—few drops of light oil in bearings every 100 to 300 hours as recommended in instruction manual.
 6. Air Cleaner—remove whole assembly and clean thoroughly including element. When working in continued dusty conditions, every 100 hours.
 7. Cooling System—drain and flush every 100 to 200 hours, or twice a season.
 8. Sparkplugs—clean and check gap every 200 hrs.
 9. Distributor and Magneto—inspect every 200 hours. Clean breaker-point chamber and check clearance of points. Dress points if necessary.
 10. Pneumatic Tires—wash, clean and inspect treads for cuts and other defects. Repair if necessary.



water to the battery, re-gap spark plugs or replace them if necessary, change the oil filter and keep tires inflated to proper working pressures, is heading for trouble as several of these parts, such as battery, tires, and spark plugs deteriorate very rapidly with neglect. Improperly adjusted distributor and magneto points, wiring fouled with an accumulation of oil and dirt, a weak coil and dirty plugs not only result in a loss of power and more rapid wear in the engine but cause it to use an excessive amount of fuel.

Carburetors on most tractors have two adjustments, the idling adjustment and the main-jet or "load" adjustment. To obtain maximum fuel economy it's important that the carburetor be adjusted properly. Fig. 3 pictures a carburetor typical of those on tractor engines. Usually the approximately correct adjust-



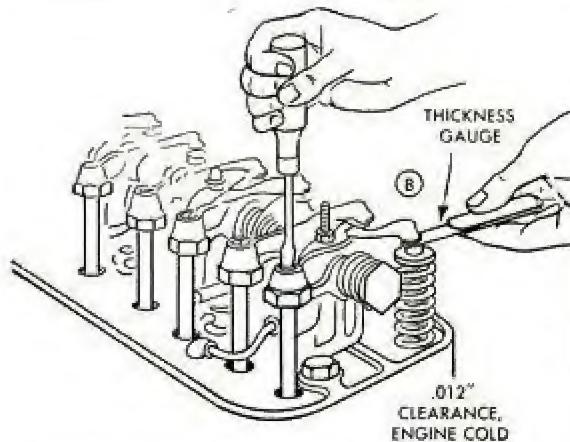
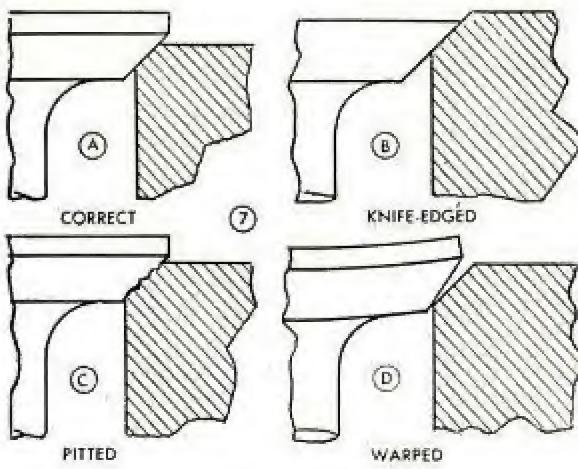


the engine picks up speed quickly and uniformly the adjustment is probably correct. But if the engine "skips" or "coughs," open the screw $\frac{1}{8}$ of a turn at a time until it picks up smoothly when the hand throttle is opened. To adjust for smooth idling, warm the engine to operating temperature, close the throttle and turn the idle-adjusting screw in until the engine begins to

run irregularly, and the exhaust sounds "rough." Then open the screw slowly, noting operation of the engine. By slow adjustment of the screw you'll find the point where the engine "smooths out," provided of course, all other parts are in proper condition. At regular intervals during the more seasonal service periods, drain the fuel tank through the carburetor and clean the fuel-filter sediment bowl and also the tiny screen at the fuel inlet to the carburetor, Fig. 4. This screen should be cleaned carefully with gasoline. While going over the carburetor, especially on older tractors, examine the throttle and choke linkage. If the small shafts carrying the "butterfly" choke and throttle valves are worn badly there may be openings large enough to admit air and dirt directly into the carburetor and intake manifold, Fig. 5.

ment for the main jet will be given as $1\frac{1}{4}$ turns of the screw from the closed position. Consult the instruction manual for the correct number of turns, as this may vary. In any case, if the mixture is too lean it tends to cut down power, which causes overheating. Although not conclusive, a simple field test for proper carburetor adjustment is to suddenly pull the hand throttle wide open when the engine is under load. If

As dirt and dust are enemies of all machinery, manufacturers have made every effort to keep it out of differential and transmission housings and particularly the engine. That's why frequent servicing of the air cleaner, Fig. 6, is so important. Under extremely dirty conditions it is advisable to service the cleaner at least twice daily. This means a thorough washing in distillate, or the so-called "white" gasoline,



and filling with clean, unused oil of the viscosity recommended by the manufacturer of your tractor. Check frequently to see that there are no air leaks in the tube leading from the air cleaner to the carburetor.

In Fig. 7, detail A shows how a valve should seat, and details B, C, and D show three common defects. For purposes of illustration, the details are exaggerated and, of course, a badly burned and pitted valve body does not always appear as in detail C. Valves ground to a knife edge as in detail B are sure to burn and pit in a very short time. Warped, pitted and knife-edged valves should be replaced. In later-type tractor engines fitted with valve-seat inserts the valves are usually refaced on special equipment when service is necessary. However, in older engines the valves are generally ground with hand equipment as in Fig. 9. Fig. 8 details the common method of setting clearances on engines having "overhead" valves. When setting valves after grinding them, it is necessary to set the clearance twice, as it generally is recommended that the cylinder head be tightened in two stages, the second time after some hours of operation. Therefore, it is necessary to reset the valve clearances after this second tightening of the cylinder head. The .012-in. clearance given in Fig. 8

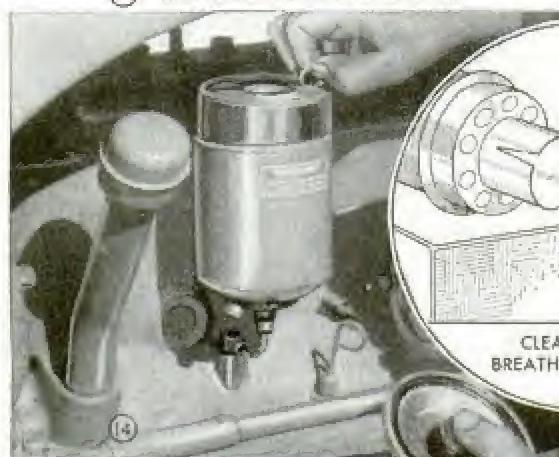




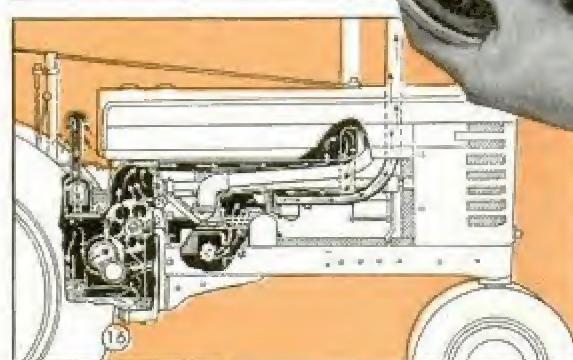
(12) CHECK CRANKCASE OIL DAILY



(13) KEEP GEAR OIL TO PROPER LEVEL



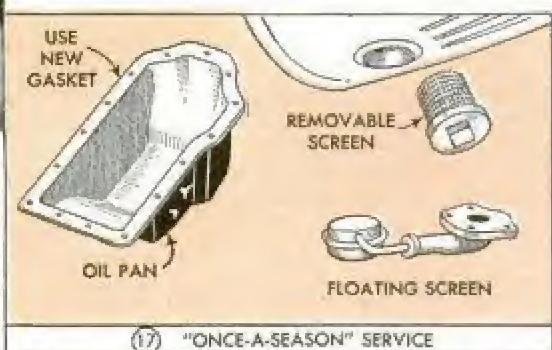
CLEAN ENGINE BREATHER CAP DAILY



is not universal. Refer to your instruction manual for the recommended clearance. Whenever the cylinder head is removed, scrape away all carbon, as in Fig. 10. When replacing the head, use a new gasket and be careful to tighten the nuts uniformly, Fig. 11, and in the order recommended by the manufacturer. This is important because it's the only way to be sure the head fits squarely on the cylinder block. After the engine has been run for some time, it's a good idea to go over the nuts again and a general recommendation is to tighten with a torque-indicating wrench to a 50-foot-pound tension.

Some tractors are equipped with two dipsticks, one for the crankcase, Fig. 12, and one for the transmission and differential, Fig. 13. Checking oil levels and changing the oil-filter cartridge, Fig. 14, are important service operations. This is especially true of the filter cartridge. Therefore, it is a good idea to keep a record of the changes. More likely to be overlooked at the regular service checks, however, is the engine breather cap. Fig. 15 shows one type, Fig. 16 another, the latter operating on a somewhat different principle. The caps are fitted with filter elements, which should be cleaned often. Some makers recommend once each day in dusty conditions. Fig. 17 shows two "once-a-season" service jobs. The first one is to remove the oil pan and clean it thoroughly, and the second one is to clean the oil-pump screen. On some tractors you will find that the screen is attached to the oil-pan plug and is removed with it.

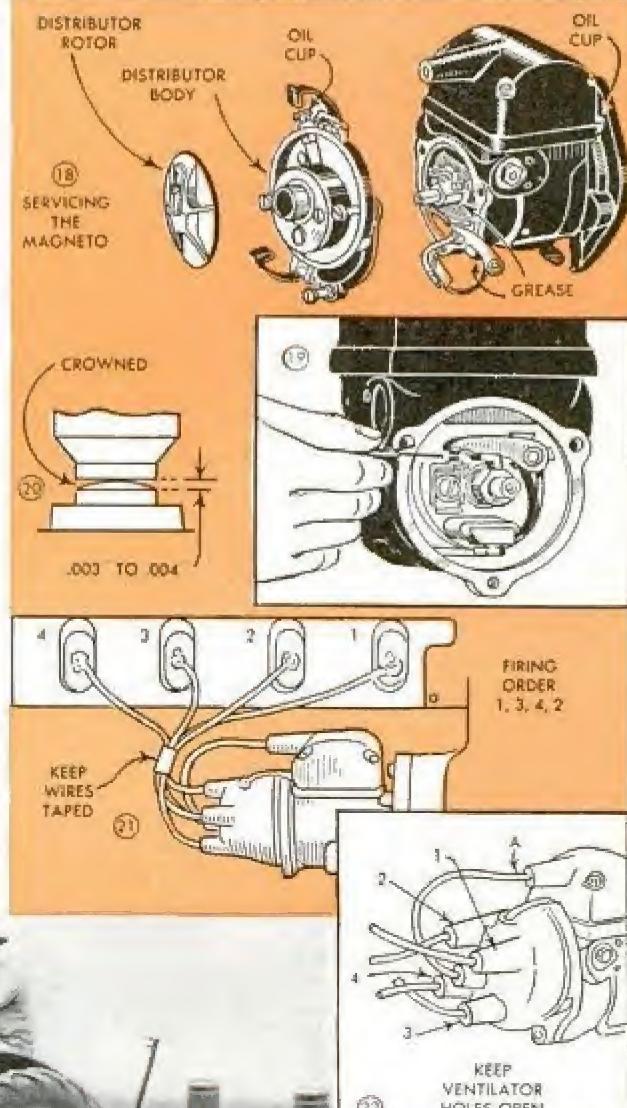
Due to the construction of magnetos on later-model tractors, minor servicing is limited to a few drops of oil at regular intervals on the impulse coupling and the distributor shaft, a small quantity of grease on the breaker cam, and an occasional dressing and ad-

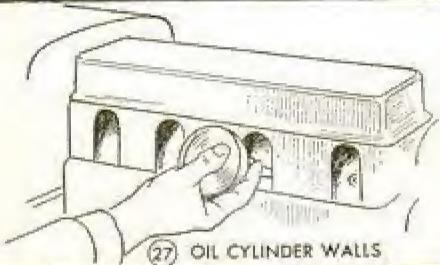
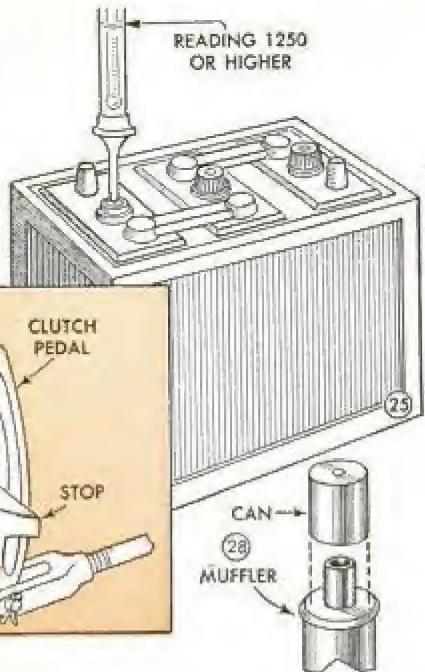
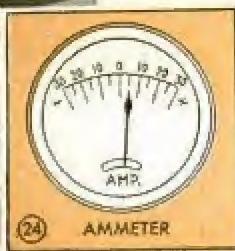


(17) "ONCE-A-SEASON" SERVICE

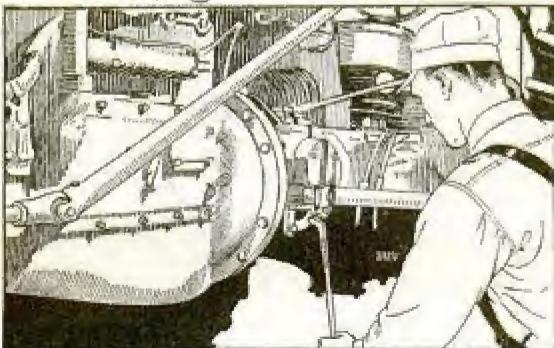
justing of the breaker points. Figs. 18 and 19 show this type magneto partly disassembled. It's important to keep the breaker-arm chamber clean, as an accumulation of oil and dirt causes rapid wear. The chamber should be inspected at regular intervals and the points checked with a thickness gauge as in Fig. 19. In dressing breaker points, use a sharp, fine file and crown one of the points as in Fig. 20. When you remove the distributor body, be sure not to crank the engine or it may be necessary to re-time the magneto. When it is necessary to remove the magneto, re-time and re-wire it according to the instruction manual. On later-type magnetos this usually is a simple operation, but you will have to know the firing order of the cylinders, Fig. 21. However, the firing order given is not universal. Lastly, be sure that Cable A in Fig. 22, is pushed firmly into the sockets and that the ventilator holes in the distributor cap are open. Usually it is best to take old-type magnetos to a skilled mechanic for service and repair.

On tractors equipped with battery ignition or with separate battery for starting and lighting, it is necessary to keep the generator-charging rate at the minimum which will assure a fully charged battery at all times. Adjusting the charging rate on most generators is done by changing the position of the third brush, some generators being equipped with a screw adjustment as in Fig. 23. By trial adjustment of the generator at the average engine speed you use in field work and frequent checks with a battery hydrometer, Fig. 25, you can determine the rate that will maintain a full charge without "boiling" the battery solution. Usually this will be





(27) OIL CYLINDER WALLS



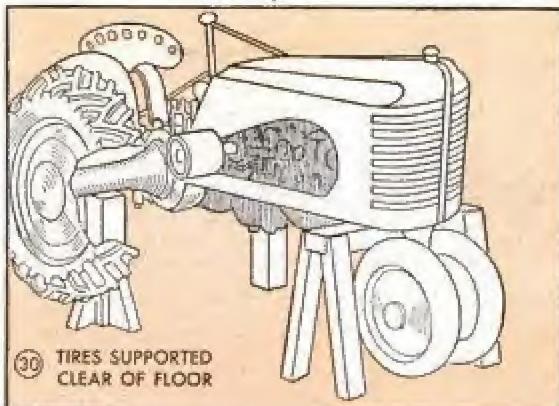
(28) MUFFLER

under 5 amps. as in Fig. 24, when the electrical system is in good condition.

An important periodic adjustment which should not be overlooked is clutch-pedal clearance shown in Fig. 26. An adjustment also is provided on tractors equipped with a hand-operated clutch. In either case the purpose of providing proper clearance is to prevent slippage due to the clutch not being fully engaged. On the foot-operated type of clutch the pedal-to-stop distance varies in the recommendations of different manufacturers. Refer to your instruction manual. And don't forget to grease the clutch-release bearing, as in Fig. 29, on tractors provided with an outside pressure-grease fitting. On some tractors this is a ball bearing of the grease-sealed type which requires no lubrication.

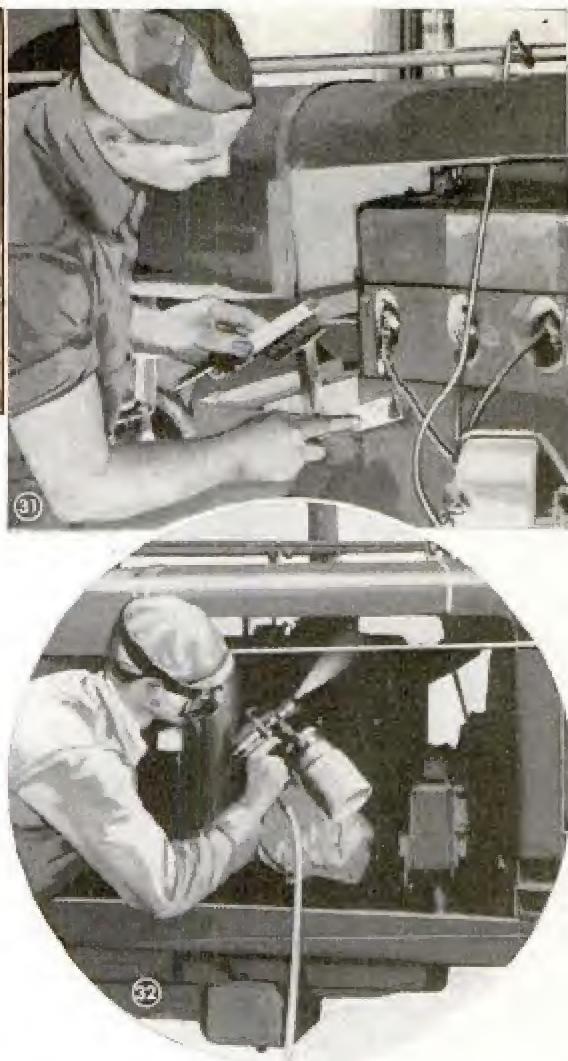
When the tractor is stored or must stand unused for more than 30 days, several precautions should be taken. Drain all fuel through the carburetor and if there is dan-

ger of freezing, drain the cooling system and flush it out with clean, soft water. Wash out the air cleaner and add fresh oil. This will prevent any accumulation of dirt settling and "caking" in the oil receptacle. Drain crankcase and oil filter, and if necessary, the transmission. Add fresh oil. Remove the battery and have it charged at regular intervals. Also remove the spark plugs and pour $\frac{1}{8}$ to $\frac{1}{4}$ pint of medium crankcase oil in each cylinder as in Fig. 27. Crank engine 40 to 50 turns, to distribute oil to all moving parts. Then remove the valve cover and "paint" the valve stems and springs with medium oil. Press a clean rag into the exhaust pipe or muffler and the breather pipe to prevent moisture entering the engine. Cover upright mufflers with a small can as in Fig. 28. Wash all mud and dirt from the tires and inflate to full recommended pressures and keep pressures up during the storage period. Fill any small cuts or breaks in the tire treads with a prepared cut filler. Before putting the tractor in service, re-oil the cylinders and valves as described, check tires, and don't forget to remove the rag plugs from exhaust and breather pipes. Where pneumatic-tired tractors must stand idle more than 30 days it will pay well to use wood supports, as in Fig. 30. These should be high enough to support the tractor with the tires clear of the floor. The front support can be made from 4 by 4-in. stock in the same way as an ordinary sawhorse. Usually, a single length of 4 by 4-in. stock will do for each rear support. Saw triangular-shaped wing braces and nail to opposite sides of one support as shown. Then when the tractor is jacked up, place the



supports in the position indicated. This arrangement will prevent tipping. After a tractor has stood for some time unused it's a good idea to loosen transmission and differential drain plugs so that any moisture which has collected in the housings can drain out. Be sure to tighten the plugs after draining. Also, it's a good idea to check them occasionally during the work season. Even though it may be necessary to partially replenish the solution several times during the season, continued use of a rust inhibitor will avoid a lot of trouble with the cooling system. Bugs, dirt, and chaff will collect in the radiator fins and must be washed out occasionally with a hose.

It's a good practice to keep a tractor reasonably clean. Scrape off accumulations of oily dirt and mud with a putty knife and wire brush, Fig. 31, and then wipe off with rags or a paintbrush soaked in gasoline, distillate, or kerosene. Always have tractor in the open while cleaning. If you use gasoline, don't scrub metal parts with a wire brush. Strike a spark from metal with the brush and you may have a serious fire. Many owners paint their tractors regularly, Fig. 32. It's a good practice and it pays to do a thorough job.



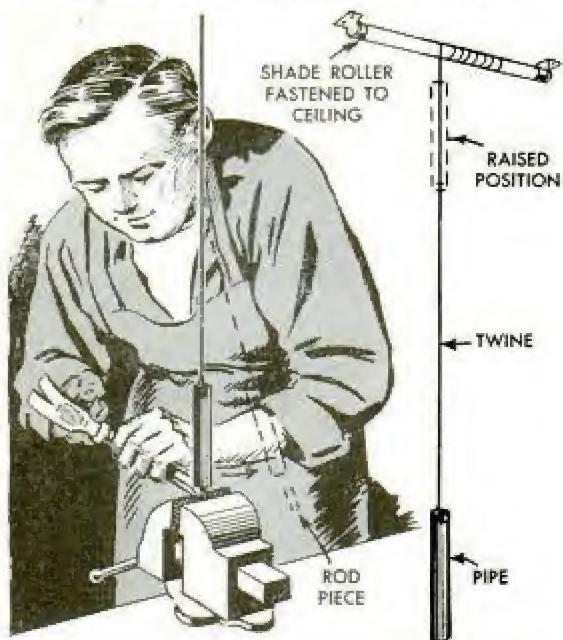
Photos and some details in this article by courtesy of Allis-Chalmers Co.—Caterpillar Tractor Co.—Harry Ferguson, Inc.—International Harvester Co.—J. I. Case Co.—John Deere Tractor Co.—Massey-Harris Co., Inc.—Minneapolis-Moline Power Implement Co.—Oliver Farm Equipment Co.

Simple Precautions That Help Avoid Fires in Automobiles

In many cases, a fire that destroyed or seriously damaged a car could have been avoided by a few simple precautions. Practically all wiring in a car is "hot" with relation to the metal of the frame or body. Consequently, should the insulation on a wire wear through, a short circuit and a fire may result. When parked with lights off, the wiring that is "hot" includes only that from the battery to the switches, plus the lead to the generator or regulator. Therefore, check these wires to see that they cannot vibrate against sharp metal edges. Tape all worn spots. When the car is running, the amount of "hot" wire is increased accord-

ing to the switches that are turned on. The addition of accessories frequently results in extra lengths of wire which often are wound around any convenient object in order to take up the slack. Sometimes fires are started by heater wires wrapped around a gas line, or taillight wires are allowed to ride loose across gas tanks or gas lines. Another cause of fire is an overheated motor in which an alcohol coolant is used. Here the fumes resulting from overheating may explode or burn with disastrous results. Consequently, checking hose connections, radiator coolant level, and fan belt condition is also important.

Suspended Pipe Catches Rod End When Cut Off With Chisel



One mechanic, who frequently had to cut off the ends of rods with a cold chisel, rigged up this holder to prevent the severed ends of the rods from flying about and possibly injuring someone. The holder consists of a short piece of pipe which is suspended from the ceiling by means of a window-shade roller. In use, the pipe is slipped over the end of the rod before cutting it off. When not in use, the pipe is raised up out of the way.

Adding-Machine Tape Weighted To Hold It for Checking

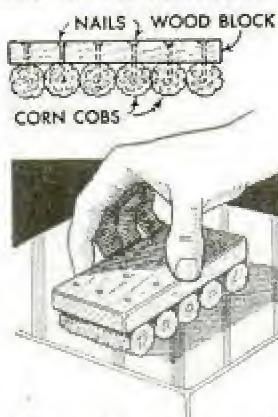
The difficulty of holding a strip of adding-machine tape on the typewriter or machine table for checking or typing may



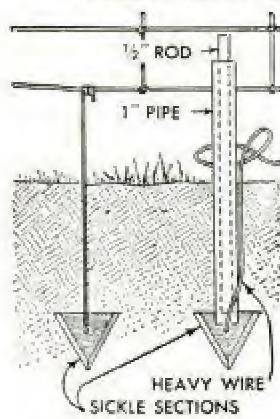
be overcome by attaching paper clamps to the ends of the tape to serve as weights. The clamps are applied or removed easily, provide just enough weight to hold the tape in position, and permit it to be moved over the edge of a table as the checking progresses.—G. E. Hendrickson, Argyle, Wis.

Scrubbing Brush of Corncobs

Difficulty of obtaining scrub brushes to use in scouring vats and tubs in his dairy led one farmer to improvise some from corncobs. Each brush consists of a block of wood having spikes driven through it to project about $\frac{3}{4}$ in. The clean cobs are impaled on the spikes and are rough enough to do a thorough job of scouring. The cobs may be turned to present new cleaning surfaces, and complete replacement costs no more than the few minutes time involved to install new ones.



Fence Anchors on Rough Ground Made From Sickle Sections



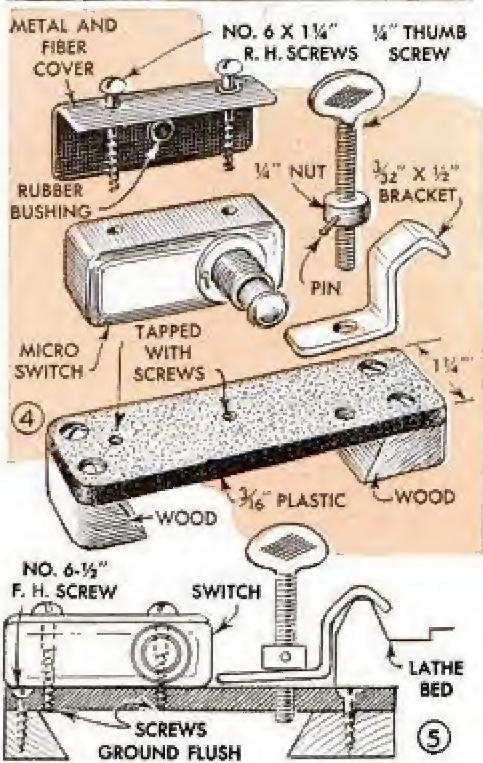
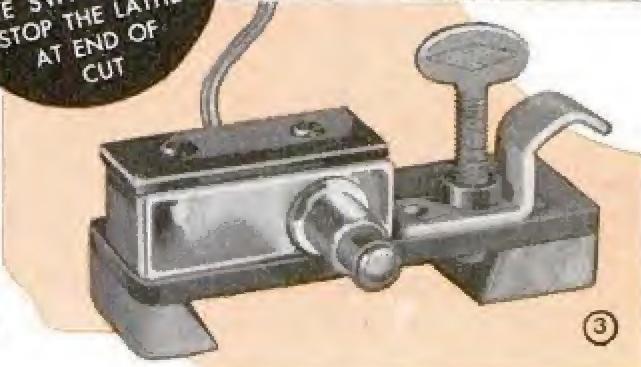
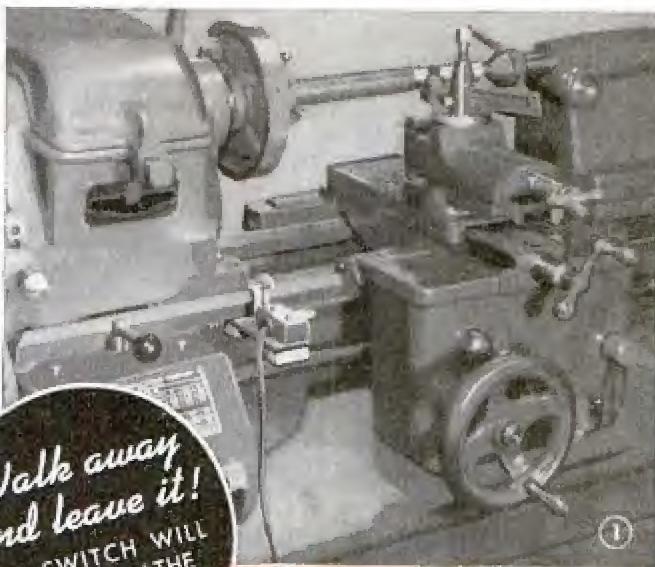
When a fence is strung over uneven ground, often it is necessary to anchor the wires in certain places to keep them close enough to the ground. For this purpose, we find that old mower sickle sections are highly suitable when driven into the ground and tied to the fence wires with lengths of anchor wire. To drive the sections we use a length of 1-in. pipe, which is notched at the lower end to fit over the sections. If these tend to stick in the slot when pulling the pipe from the ground, a length of rod can be inserted inside the pipe to knock them loose.

—E. R. Gorton, Maryville, Mo.

The annoyance of short or uneven strokes of an old windshield wiper often can be overcome and the wiper adjusted to clean a larger area by changing the position of the arm hub on the serrated shaft.

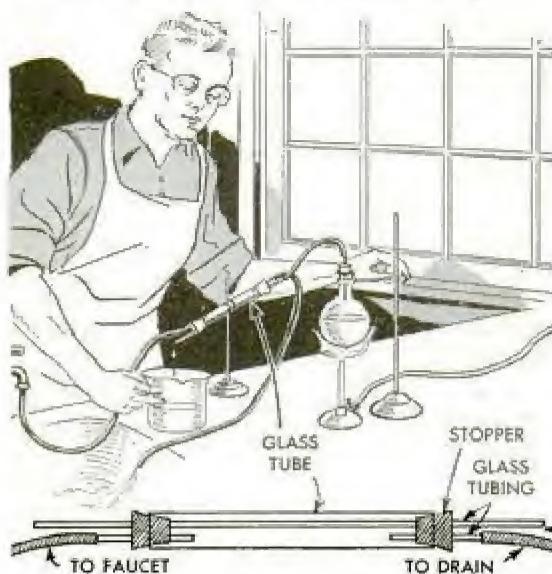
Stop Switch Provides Automatic Lathe Control

Long cuts on a lathe often require several minutes for completion, during which time the operator must remain at the machine. The lathe can be stopped automatically at the end of the cut by using a simple stop switch clamped to the lathe bed as in Fig. 1 or to the carriage as in Fig. 2 to control spindle and faceplate cuts. While almost any type of snap-action switch that breaks contact by pressure on a button can be used, the precision type of micro switch



shown in Fig. 3 is recommended. This switch is a snap-action, pin-plunger type that makes positive contact with less than .0005 in. travel, and can be obtained at most electrical supply houses. Actual construction of the switch mounting is simple. As indicated in Fig. 4, a metal bracket clamps to the lathe bed at any point, while a V-bottom piece permits mounting on the cross slide, a thumb screw providing clamping action in either position. Wiring is simply a matter of breaking one of the power leads at the lathe switch. In use, the lathe carriage is moved to the point where the cut is to end, after which the switch is clamped to the lathe bed so that the pushbutton is touching the side of the carriage. Then the carriage is backed off and the cut started. When the side of the carriage contacts the switch, the lathe stops. There is a matter of coasting action to be considered. The switch has an overtravel to take care of this. As far as the work itself is concerned, the coasting action of the average lathe is less than two revolutions, which is negligible at average feed rates. When not in use, the switch is pushed to the headstock end of the bed where it is out of the way. In this position, it is useful as a thumb switch for momentarily stopping the lathe.

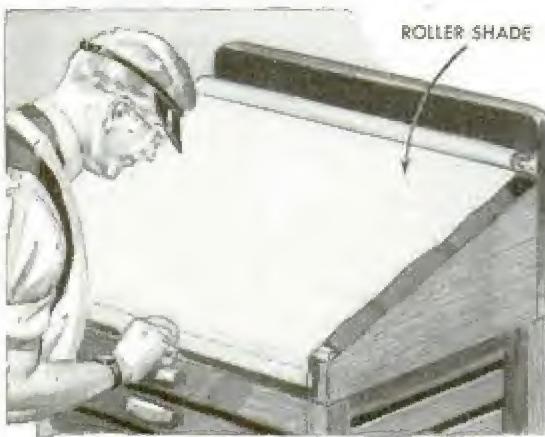
Emergency Laboratory Condenser Made From Glass Tubing



It's a simple job to make an emergency condenser for use in a laboratory. All you need is one long and two short lengths of small glass tubing and one length of large glass tubing, such as a tube that contained photo developer. Assemble the tubing as indicated, using two rubber stoppers to plug the ends of the large tube. The stoppers must be drilled for the insertion of the smaller tubes. By means of rubber tubing, connect one short tube to a cold-water faucet and the other to a drain. The long tube, of course, is connected to your apparatus to carry the vapor that is to be condensed.—W. C. Roher, Jr., Vernon, N. J.

Dust Kept Out of Type Case By Window-Shade Cover

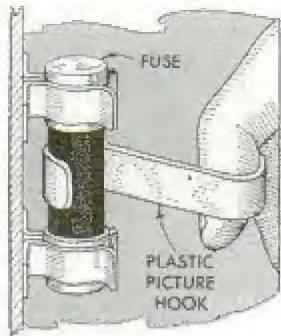
Type cases that are left on top of the racks in a print shop soon gather so much dust that setting type is a messy and unpleasant task. To avoid much of this dust



accumulation, one printer obtained window shades of a width to fit across the cases and attached them to the back of the racks so they could be pulled over the type or removed in a jiffy.

Large Cartridge Fuses Pulled With Plastic Picture Hook

Large cartridge fuses often become corroded in their holders so that they are difficult to pull out. To do this safely, one electrician found that a plastic picture hook was ideal. The hook being non-metallic, there was no possibility of an electrical shock if the hook accidentally touched the holders.



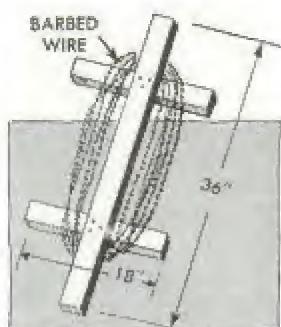
Simple Holster Keeps Micrometer Within Easy Reach of Worker



One worker who had to use a micrometer in his inspector's job in a factory used a holster like the one shown. The holster kept the micrometer where it was easy to reach at all times, and also helped to keep the instrument from rusting due to contact with his hands. The holster is made from a leather cigarette case, the flap of which is folded over the rear side of the case and sewed to it to form a loop for insertion of the trouser belt.—Allen Fiske, Chicago.

Handy Reel for Barbed Wire

The next time you have short lengths of barbed wire to roll up for future use, nail three pieces of wood together to provide a good portable reel. In use, grasp the reel by the center arm and shift slightly to hook the wire over the ends.





Radio

Sergeant Builds 'Pee-Wee' Radio From Salvaged Parts

"THEY wanted a young fortune for an old beat up piece of tin," says Sergeant Donald L. De Velder of Rochester, N. Y., a member of a mobile chronograph crew in the Panama Coast Artillery Command, after spending fruitless months in search of a radio. Deciding to solve the problem for themselves Sergeant De Velder and Staff Sergeant Emmet Ellis, of Niagara Falls, N. Y., assembled this three-pound "pee-wee" radio receiver from spare parts retrieved from junk heaps. Plugged into a wall socket, with a short antenna trailing down De Velder's foot locker he can now tune in the local Armed Forces Radio Station and other Panama wavelengths. Sergeant De Velder's broad grin testifies to satisfactory results as he is shown getting an earful of the latest news.

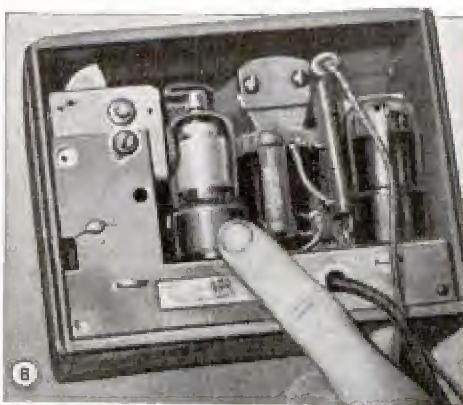
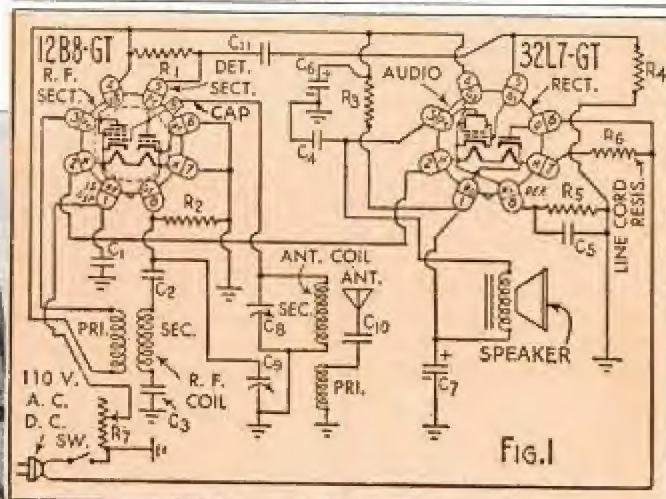
The tiny set is a 2-tuber, 6 in. wide, 6 in. long and 3 in. deep, and housed in a simple cabinet made of plywood. The list of parts, and schematic circuit diagram, Fig. 1, were prepared from data supplied by De Velder. The coils have to match the tuning condenser used; a small magnetic speaker was employed. The only expense involved in the undertaking was for the 32L7 tube the Sergeant is pointing out in the lower photo, which cost him \$2.00. "Back in the States," Sergeant De Velder says, "I could have bought the same tube for 69 cents."



(A)

L I S T

R1-.5 megohm 1/2 watt	C1-.05 mfd. 200 v. (paper type)
R2-10 " 1/2 watt	C2-.01 mfd. " " "
R3-1000 ohms 1/2 watt	C3-.2 mfd. " " "
R4-.5 megohm 1/2 watt	C4-.1 mfd. " " "
R5-200 ohms 10 watts	C5-.02 mfd. 600 v. " "
R6-300 ohms 10 watts	C6 & C7-20 mfd. elect. 150 V.
R7-10,000 ohm midget vol. cont. with switch	C8 & C9-365 mmfd. (ganged) var. cond.
	C10-.02 mfd. 200 v. (paper type)
	C11-.002 mfd. 600 v. "



SHORT-WAVE "J-B THREE"

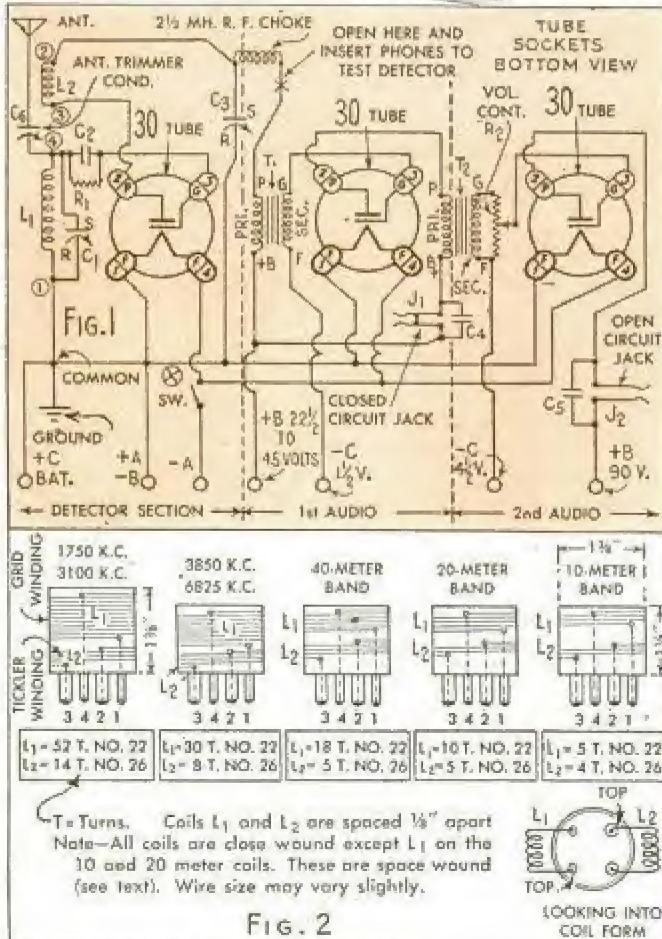


By L. B. Robbins

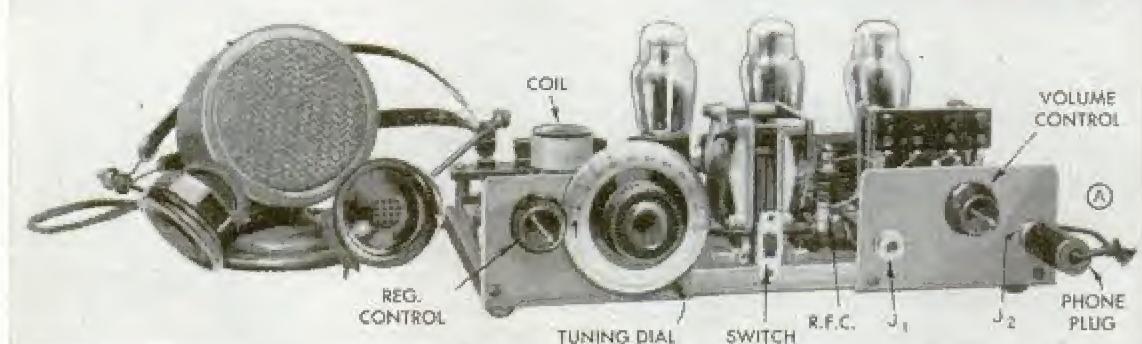
NOW you can use those old discarded battery set tubes to make a good short-wave receiver. Strictly "junk box" down to the very last nut and screw, this experimenter's 3-tuber will operate with either type-30, 199 or 201-A tubes by merely changing the "A" battery, either dry cell or storage type, to suit the filament requirements of the tubes used. Do not use a.c. on the filaments of battery-type tubes.

Designed for either headphones or a small speaker, it covers the short-wave bands from 10 to 160 meters by means of hand-wound plug-in coils wound on bases removed from discarded 4-prong tubes. Winding (L_1) on the 10 and 20-meter coils is space-wound, the turns being about $\frac{1}{8}$ of an inch apart. Duco cement holds the windings on the coil forms. The schematic circuit diagram is Fig. 1, and all coils are detailed in Fig. 2; the pictorial wiring diagram appears in Fig. 3. Ordinary bell wire is used for connections; the wire for the coils can be either cotton, silk or enamel-covered.

The bottom of the wood base



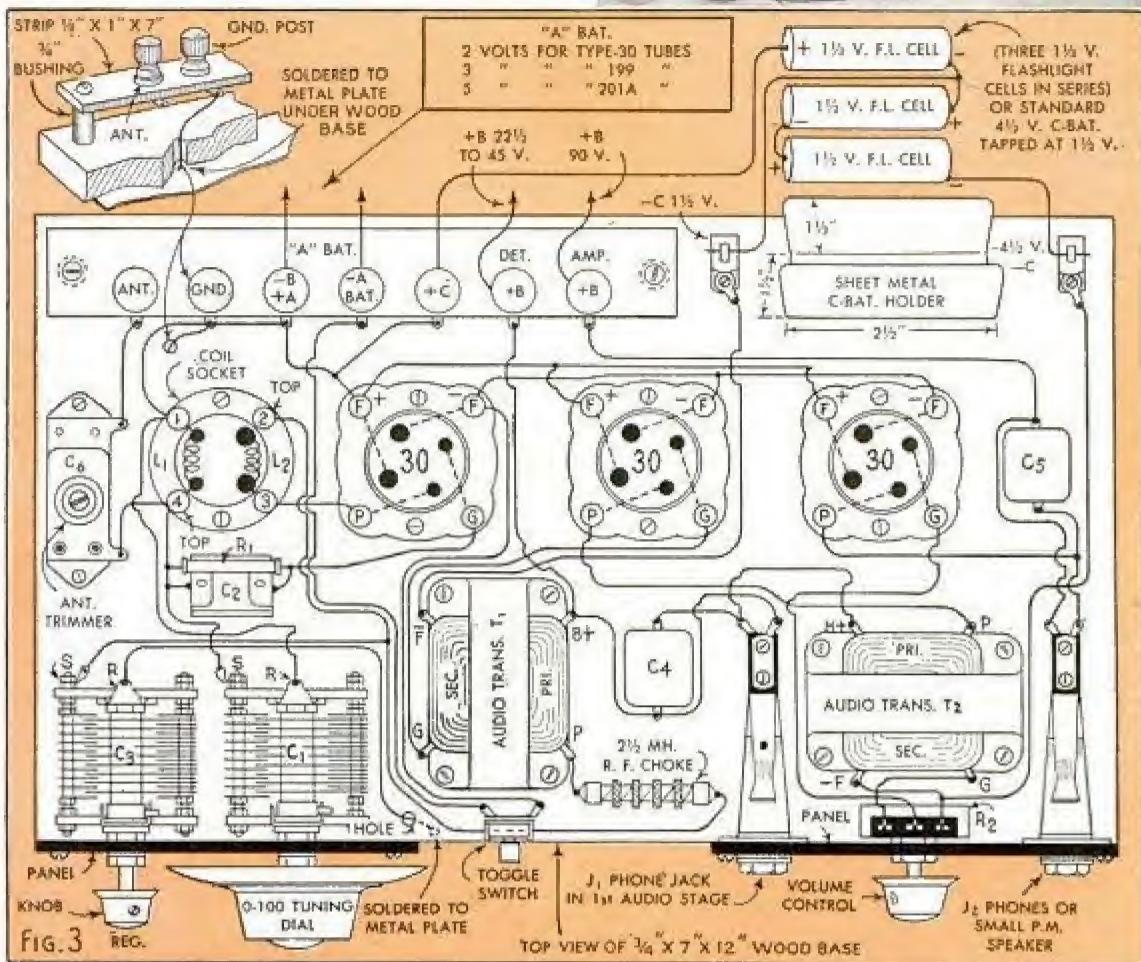
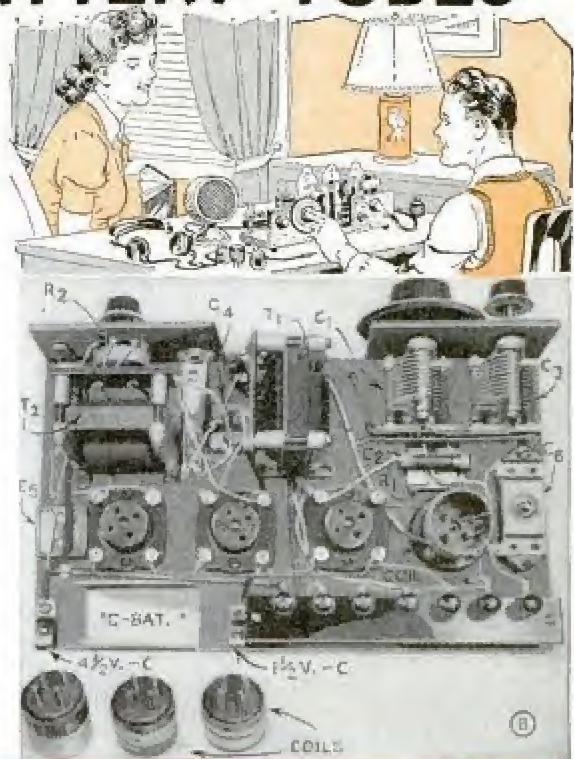
- LIST -**
- C₁ & C₃ = 100 mmfd. (.0001 mfd.) variable condensers
 - C₂ & C₄ = .0001 mfd. fixed condensers (any type) (Note—C₂ can be .00025 mfd.)
 - C₅ = .002 mfd. fixed condenser (any type)
 - C₆ = 3-35 mmfd. trimmer or paddler condenser (any type) (not critical)
 - R₁, = 5 to 8 megohm fixed resistor (grid leak)
 - R₂ = 500,000 ohm variable resistor (volume control)
 - T₁ & T₂ = 3-1, or 3 1/2-1 ratio, audio transformers (any type)



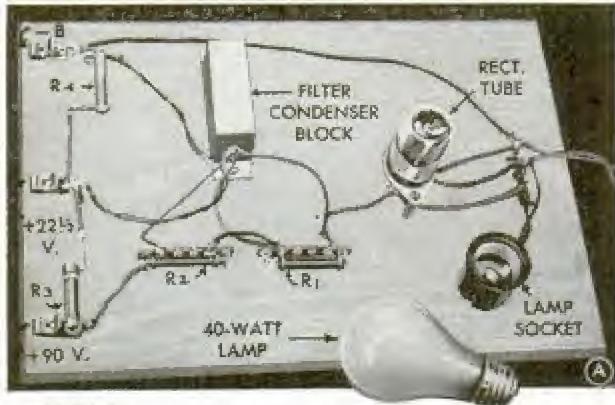
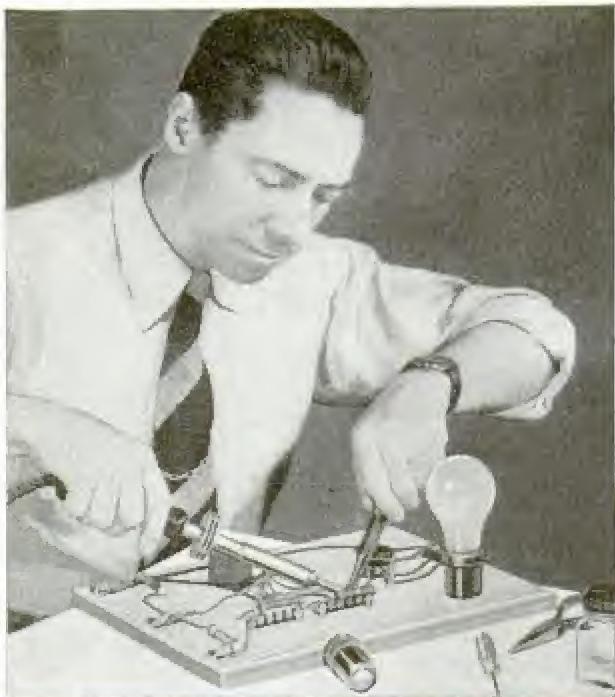
USES OLD BATTERY TUBES

board is covered with a piece of metal held with four rubber feet. Two soldered connections are made to this metal sheet on the underside. The hard pressed wood control panels are $\frac{1}{8}$ by $2\frac{1}{2}$ by $4\frac{1}{4}$ in.

Try various detector B-voltages to find the value for best reception. Detailed student material list R-329 is available from Popular Mechanics radio department, upon receipt of postage. The B-power supply can be two 45-volt B-batteries or a simple power pack of the type described in this issue on the following page. When this B-supply unit is used, no direct ground connection can be made on the receiver. If an external ground is needed, connect a .1 mfd. 600-volt paper-type fixed condenser in series with the ground lead to prevent shorting the power line. Use a 50 ft. antenna and adjust C_6 for best results. Tune slowly and clear the signals with regeneration control C_3 . A 10 ft. antenna will be best on the very short waves; readjust C_6 when changing antennas. Refer to short-wave logs for best listening hours.



'Light Bulb B-Eliminator' for Student Receivers



40-WATT
LAMP(SOCKET). NOTE—USE NO DIRECT GROUNDS (SEE TEXT)

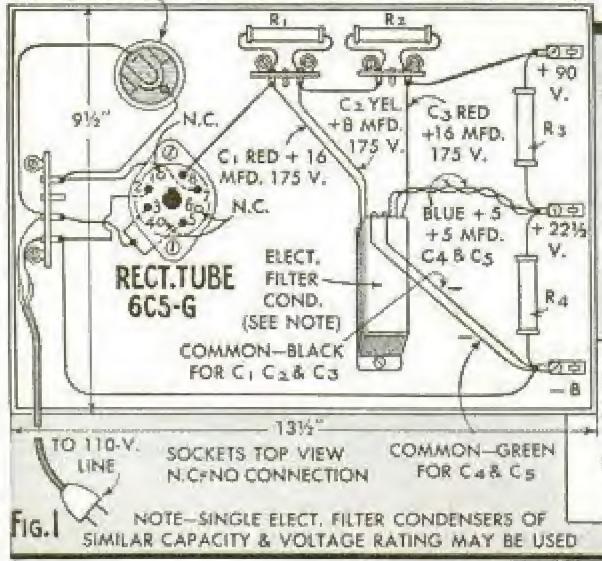
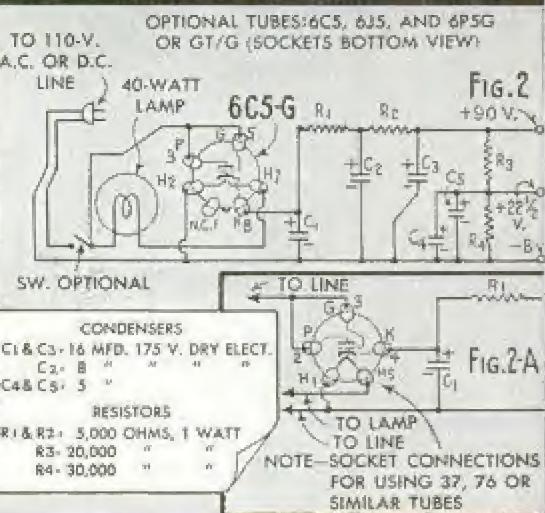


FIG. 1

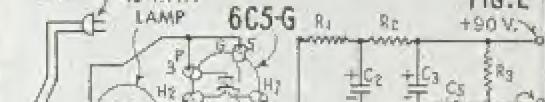
THIS easy-to-build B-battery eliminator will furnish up to 90 volts of B-voltage for the average small battery receiver. No power transformer, filter choke or line-cord resistor are required for this useful "breadboard" power unit. All filtering is accomplished by means of four carbon resistors and an ordinary a.c.-d.c. dry electrolytic condenser block.

Although a 6C5-G tube is employed as a rectifier in the simplified wiring diagram Fig. 1 and the schematic circuit diagram Fig. 2, it could just as well be a 6C5-GT, a 6C5-GT/G, or, several other common types as indicated in Figs. 2 and 2-A. The usual line-cord resistor is not necessary as the voltage drop is provided by an ordinary 40-watt light bulb which must be used. The tube socket is supported on 2 in. bushings; tiepoint strips, and three Fahnestock clips provide all terminal connections. The electrolytic condenser block has two 16 mfd. sections and one 8 mfd. section all rated at 175 volts peak. In addition there are two 5 mfd. 35 volt sections parallel to provide 10 mfd.

Most small battery sets will operate satisfactorily on any B-voltage from 60 to 120 volts. The $22\frac{1}{2}$ volt tap is for the detector stage. Operate the unit 3 or 4 ft. from set and protect from handling. As this is an a.c.-d.c. unit do not use a direct ground on any receiver for which this power supply furnishes B-voltage. If a ground is necessary connect a .1 mfd. 600-volt paper condenser in series with the receiver ground lead.



OPTIONAL TUBES: 6C5, 6J5, AND 6PSG OR GT/G (SOCKETS BOTTOM VIEW)



RESISTORS
R1 & R2 = 5,000 OHMS, 1 WATT
R3 = 20,000 " " "
R4 = 30,000 " " "

CONDENSERS
C1 & C3 = 16 MFD. 175 V. DRY ELECT.
C2 = 8 " " " "
C4 & C5 = 5 "

NOTE—SOCKET CONNECTIONS FOR USING 37, 76 OR SIMILAR TUBES

Here's how your car FEELS . . .

... after

MARFAK

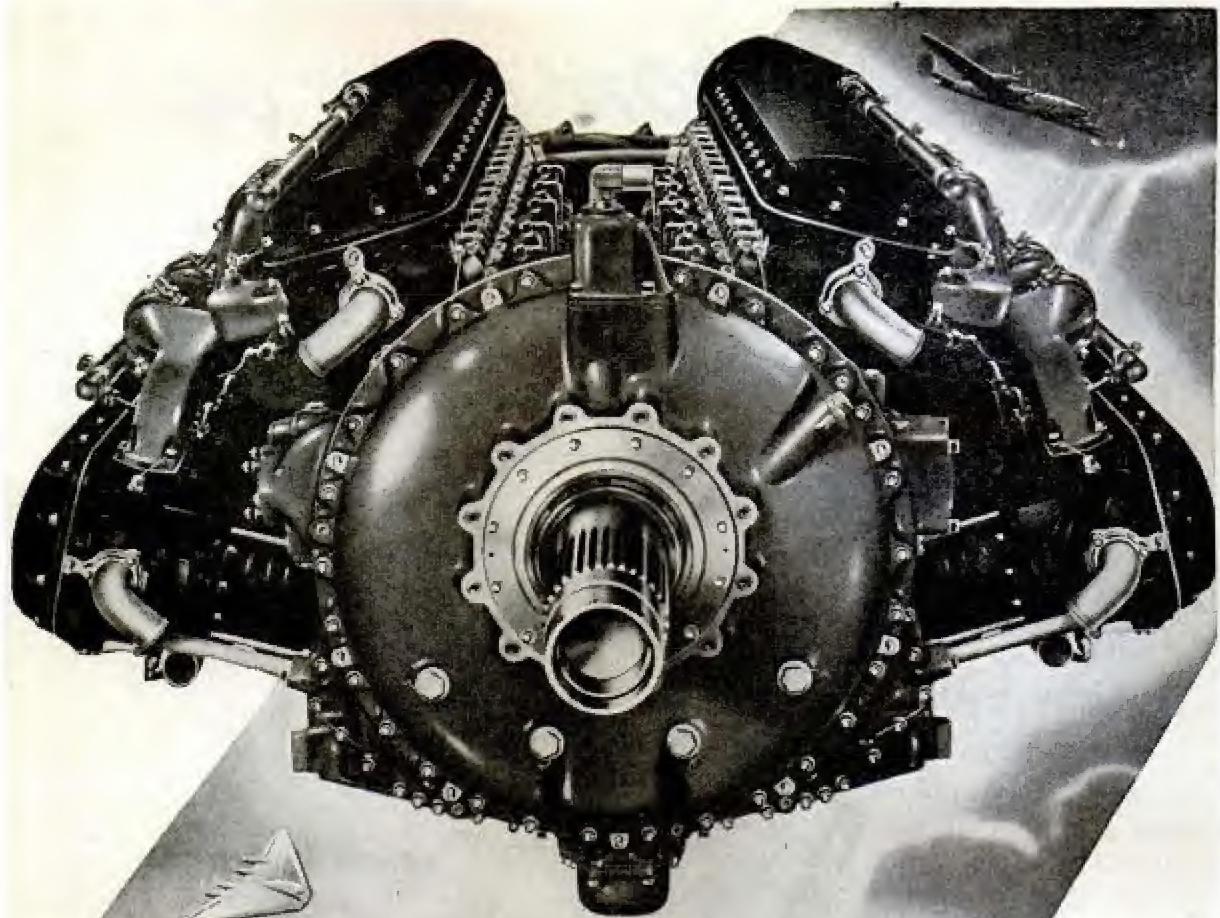
chassis
lubrication!

Now's the time for MARFAK chassis lubrication. Keeps your car *limber* despite freezing weather, makes winter driving smooth and effortless. MARFAK is extra tough and long-lasting. And your Texaco Dealer applies it by chart . . . never by chance! Every point of wear, every point of adjustment gets a going over . . . from tie rods to spring shackles. But don't wait. Colder weather's just around the corner. Ask your Texaco Dealer to give your car that "MARFAK feeling" today!

THE TEXAS COMPANY



TUNE IN the TEXACO STAR THEATRE starring James Melton every Sunday night. See your local newspaper for time and station.



A LIQUID-COOLED GIANT — THE WORLD'S MOST POWERFUL

Going into America's new planes is the most powerful liquid-cooled aircraft engine in the world. ★ It is an Allison engine — of approximately 3,000 horsepower. It is more powerful by hundreds of horsepower — gives our pilots over a third more power to work with than the huskiest engine they had before. ★ Virtually all its parts are the same as in other Allisons. So plane crews around the world can service it right now. ★ Its high power, long range, smoothness and dependability are qualities vital in the days of war, and equally important in the planes in which you will fly when peace returns.

KEEP AMERICA STRONG
BUY MORE WAR BONDS

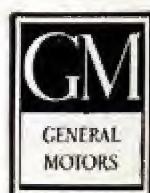
POWERED BY ALLISON

P-38—Lightning
P-39—Airacobra
P-40—Warhawk
A-36 and P-51—Mustang
P-63—Kingcobra

The more-than-50,000 Allison engines built for the U. S. Army Air Forces power the above planes.

LIQUID-COOLED AIRCRAFT ENGINES

Allison
DIVISION OF



Indianapolis, Indiana

Every Sunday Afternoon

GENERAL MOTORS SYMPHONY OF THE AIR — NBC Network



Motorola Radio "Handie Talkie" co-ordinating our march to Victory



The story of every great Victory of our armed forces has been a story of teamwork . . . split-second timing and miraculously unified attack. Radio ties all combat arms together.

Motorola Radio Engineers have developed, built and delivered in great quantity such battle-famous radios as the Walkie-Talkie, the "Handie Talkie," the Cavalry Guidon Set, and the power-

ful two-way unit that moves on wheels.

Much of this equipment has been of the F-M (Frequency Modulation) type. This is the staticless, noiseless radio you will enjoy when Victory restores peace and normal living to our America.

There will be Motorola Radios soon again for your Home and Car. F-M, Television, other Electronic developments? You bet! Motorola will have them all!

Like the "Handie Talkie" this Tiny Portable is a notable Motorola Radio First!

Thousands know the Motorola "Playboy" as the smallest, most powerful personal portable radio on the market. It plays richly, beautifully, on planes, trains . . . in steel constructed buildings. The marvelous thing about the Motorola "Playboy" is its size . . . no larger than a snapshot camera . . . just a mighty little handful of radio pleasure. Watch for the new post-war Motorola "Playboy". It will be a "Honey"! Buy more war bonds!



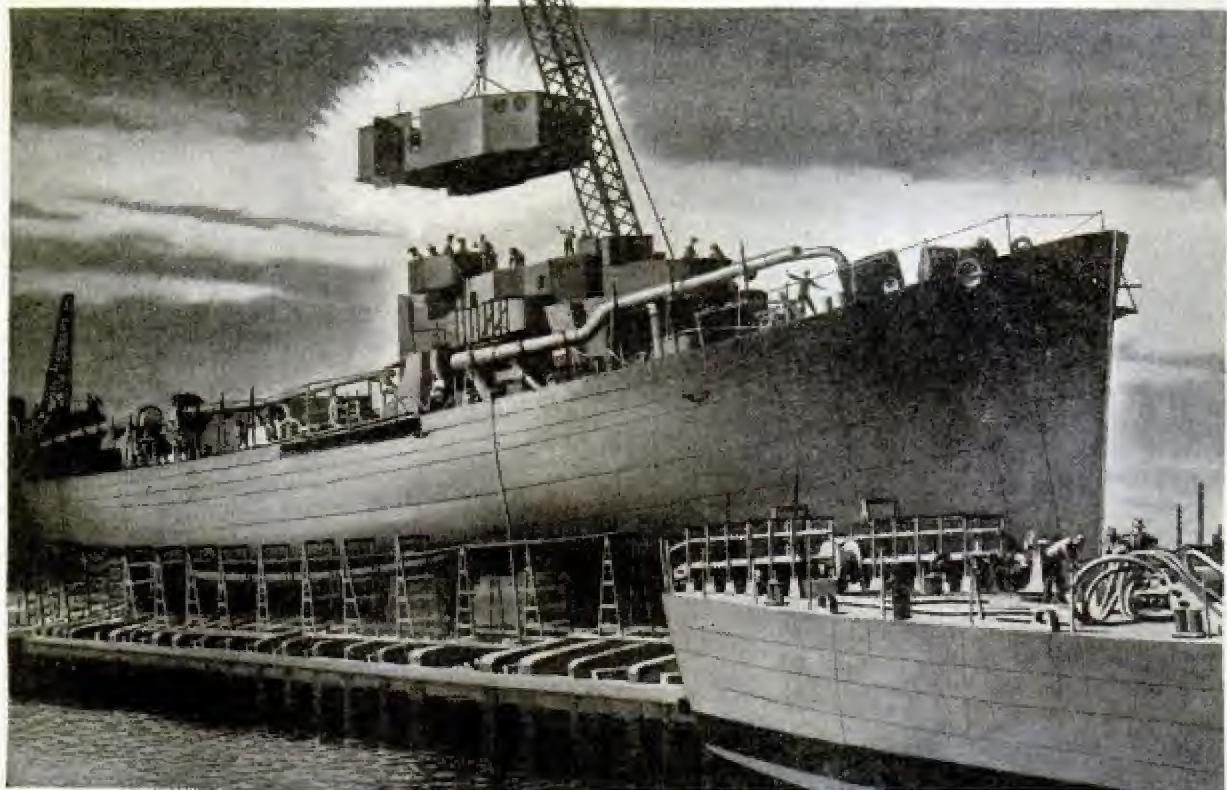
GALVIN MFG. CORPORATION • CHICAGO 51



Motorola Radio

F-M HOME & CAR RADIO ★ PHONOGRAPHS ★ RADAR ★ TELEVISION ★ F-M POLICE RADIO ★ MILITARY RADIO COMMUNICATIONS

Crown of steel for a queen



As significant in its way as the coronation of an earthly monarch, is the placing of the steel superstructure that crowns a queen of the sea. ☆ And surely a fine ship is queenlike, for she possesses regal beauty, proudly defies the wind, the weather and the sea and gives royal guardianship to the men who sail her. ☆ These qualities are imparted to a vessel by the shipbuilders—men who build with their hearts as well as their arms. Theirs is both an art and an industry—a craft and a science. ☆ For nearly forty years, Defoe has been building and *crowning* queens of the sea. Yesterday, beautiful yachts and hardy small craft came from the Defoe ways. Today, fighting ships for the Navy. Tomorrow, for peacetime America, Defoe will build private vessels and industrial products that reflect the skill and devotion typical of the shipbuilder's art. This is the only way we know how to build.

DEFOE SHIPBUILDING COMPANY, BAY CITY, MICHIGAN

BACK THE ATTACK
— BUY WAR BONDS

Defoe

SHIPS FOR VICTORY
SERVANTS FOR PEACE



Four White Star Renewal Citations
now decorate the Navy "E" Award
won by Defoe workers.



ENGINES WEAR OUT, TOO...

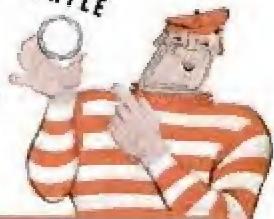


The life of an engine depends largely on the care it gets. This life can be shortened by neglect, or greatly extended by proper attention.

Today millions of engines are operating efficiently, long beyond their normal span . . . because they have been watched closely, checked frequently . . . and serviced at the first indication

of trouble. Every engine is a trust in its owner's hands. Take no chances . . . protect your vital transportation . . . replace worn parts before undue wear occurs! Consult your motor specialist regularly and often.

TOUGH BUT OH SO GENTLE



HASTINGS MANUFACTURING COMPANY • HASTINGS, MICHIGAN

Hastings Mfg. of Canada, Ltd., Toronto

★ It's a privilege to buy War Bonds

HASTINGS STEEL-VENT PISTON RINGS



TOUGH on oil-pumping • GENTLE on cylinder walls

Sixty-Yard Flash

Continued from page 85

of our pet secrets, but essentially it is ordinary motor gasoline almost solidified. Its relatively short range has limited the flamethrower's usefulness. But the M1-A1's sixty-yard flash has already been surpassed by tank-mounted flamethrowers that hurl a 150-yard jet. These were used on Saipan and against the Siegfried Line.

The British 41-ton Churchill "Crocodile" tank carries what they claim as the most powerful flamethrower in the world, throwing a geyser of fire over 450 feet. It tows its own fuel in an armored trailer.

The G. I. Hotfoot is a first cousin of the oil incendiary bombs we have showered over Nazi Europe and the Japanese isles. Both are loaded with the same gasoline jelly. The new jelly bomb is not so hot as the German magnesium bomb which flares briefly at a temperature of 3,000 degrees Fahrenheit and is harder to extinguish, but the total heat content of the gel-gasoline is almost twice as great and it burns longer.

That was proved when the new incendiaries destroyed whole Japanese and German cities on a desert in Utah. Under supervision of Standard Oil Development research men, entire cities were built secretly in a remote section of Utah. Architects familiar with Jap and German structural design and materials were employed. One had worked 18 years in Japan, another was a German refugee architect. Not only were roofing and insulation materials and joist construction duplicated as closely as possible, but the buildings were furnished in the German and Japanese manner down to the oriental tea table and the rice-straw mats, hundreds of which were rounded up from Japanese settlements along the west coast and throughout the Hawaiian islands. The job was complete in two months. Then Fortresses and Liberators and Mitchells swarmed over the cities to bomb them out of existence. All types of incendiaries and explosive bombs were used. The cities were destroyed, rebuilt and destroyed again. The gasoline-jelly bomb proved its effectiveness above all others. An interesting sidelight was the fact that, in pure destructive power, the bombs carried on Doolittle's Tokyo raid were the least effective of all. We have progressed a long way since.

The oil incendiary is devilishly ingenious. It looks like a piece of hexagonal pipe, so shaped in order that it can be packed in clusters of as many as 60, which break into individual bombs as they fall, covering a wide area. Each carries 2½ pounds of gel

(Continued to page 152)

HE HAS YOUR BATTERY



Vital cargoes must get through to our fighting men overseas! For emergency communication the Merchant Marine depends upon portable, battery-powered megaphones. We're short of batteries on the homefront now because they're needed to power countless time-saving, life-saving instruments on land and sea. Use your available Burgess Batteries sparingly . . . keep them cool and dry. For Free Battery Hints—Write Dept. E-3, Burgess Battery Company, Freeport, Illinois

The War Chest Helps Here and Overseas!

**BURGESS
BATTERIES**
IN THE NATION'S SERVICE





... WISH I OWNED IT, DAD

"Gee, Dad, I sure get a kick out of just holding your Savage rifle. Bet I can put 'em in the bull's-eye same as you do. When am I going to have a Savage of my own?"

"Can't blame you for liking this rifle, son. A Savage has always been my favorite . . . and that goes for shotguns, too.

"It won't be long now before you'll have your Savage .22. Then you and I will do some target shooting, and later on we'll go on some real hunting trips. I've got a feeling I'll be wanting a new shotgun, too."

Savage Arms Corporation

Plants in Utica, N.Y. and Chicopee Falls, Mass.

Manufacturer of SAVAGE, STEVENS, FOX Sporting Arms

SAVAGE

YOU'LL WANT ONE, TOO

As soon as war restrictions are lifted, there'll be a great variety of Savage rifles and shotguns for every shooting requirement. All the skill and precision manufacturing facilities that enabled Savage to produce huge quantities of Victory arms will assure supremely fine quality and outstanding value in every Savage model.





*Filing nicks out of propeller blade
of Budd-built RB-1 transport plane.*

EVERY detail in the maintenance of a costly giant of the air is important. Taking nicks out of a plane's propeller blade could be done—after a fashion—with a randomly selected file; but modern shop practice says, "No! Use the right file for the job." With Nicholson Files, that admonition can be obeyed. For smooth-filing aluminum and aluminum alloys (like airplane propellers), the specially designed Nicholson "Aluminum Type A" usually does the job best.

Hundreds of other filing jobs present similar situations. "Know your files and get ahead" is today's advice to the forward-looking mechanic. Know Nicholson Files and your knowledge of file types will be up to the minute.

FREE BOOK, "FILE PHILOSOPHY." It can give you more information about file kinds, use and care in half an hour's reading than months of "apprenticing" . . . 48 interesting illustrated pages.

NICHOLSON FILE CO., 22 Acorn St., Providence 1, R. I., U. S. A.
(Also Canadian Plant, Port Hope, Ont.)

NICHOLSON
FILES FOR EVERY PURPOSE

NICHOLSON
U.S.A.
MADE IN U.S.A.

gas. As it breaks from the cluster, a cloth streamer emerges from the tail and slows its fall just enough to let the bomb penetrate an enemy roof without damaging the bomb's own mechanism. Impact sets off a fuse which ignites a three to five second powder train; then an explosion of black powder and magnesium shoots out of the bomb case a flaming cheesecloth sock filled with the gel gas. Flung with enough force to send it nearly 100 yards, the sock splatters gobs of flaming goo wherever it hits.

The gel-gas incendiary bomb had one of its first combat tests over Ponape. First the bombers went over the Jap-held island and sowed blockbusters, then the "rec" planes made an inspection tour and brought back photographs of the results. A day or two later the bombers returned with a load of incendiaries, and the cameras followed up for a recheck. The gel-gas treatment had accomplished about 150 times as much destruction as an equal weight of blockbusters. The high explosives dug enormous craters and had a terrific blast effect, but the damage was more localized. The incendiaries spread over a wide territory and started innumerable destructive fires.

Heavy explosives were in favor during the early part of the war, but the Air Force has put more weight in fire bombs during recent months. At one time incendiaries formed only about five percent of our total bomb loads. Lately the proportion has been 35 to 50 percent incendiaries. In one mass raid 350,000 fire bombs were dumped on Berlin. A favorite technique is to send over first a shower of high-explosive bombs, then a second wave of planes to drop a deluge of gasoline-jelly fire bombs, and finally another wave of explosives which intensify the fires by scattering combustible debris and interfering with the fire fighters and their equipment.

Fire is a ruthless weapon, but we fight ruthless enemies. The gel-gas incendiary bomb and the flamethrower are answers to the fire-bomb attacks that in 22 days and nights set 10,000 major fires in London. In one such attack on English shipyard workers' cottages less than a dozen out of 12,000 were left undamaged.

We learned about fire from the Germans. Now the pupil is the teacher.

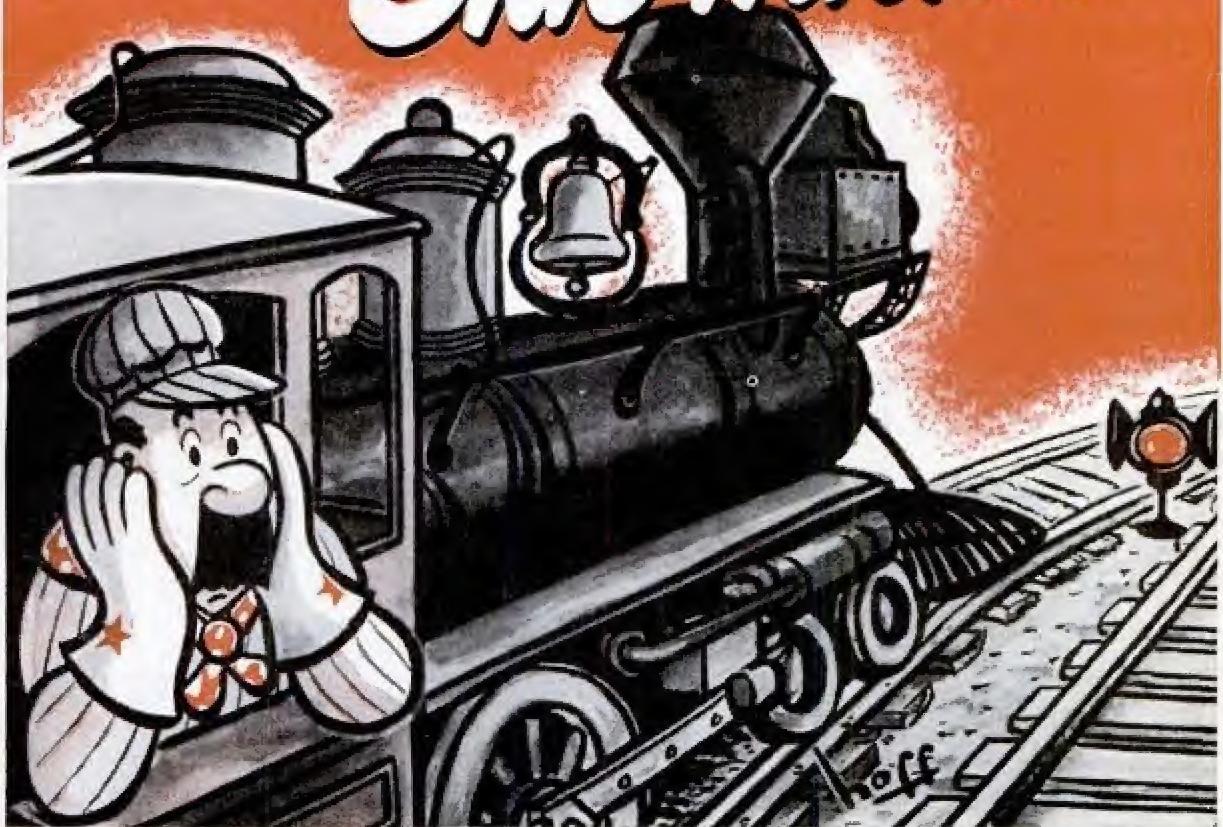
Cameramen Under Fire

Continued from page 69

pressure spring on the contact printer. The developing tank was an old Vienna sausage can, coated with a clear lacquer. The print and negative washer was made from

(Continued to page 154)

DON'T BE *Side tracked*



Switch to Auto-Lite Batteries

Be guided by the experts who choose batteries for the world's toughest transportation services. For example, the million-mile trans-ocean flying record was established by a Pan-American Clipper equipped with Auto-Lite batteries.

Auto-Lites, too, are specified for service with our

AUTO-LITE BATTERY CORPORATION • TOLEDO, 1, OHIO

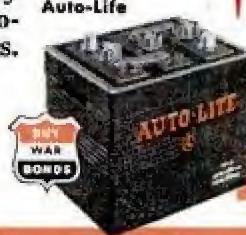
Manufacturing Plants at:

Niagara Falls • Atlanta • Indianapolis • Oakland • Oklahoma City • Toronto

fighting forces in tanks, half-tracs, jeeps . . . wherever dependable power counts.

Get the long life . . . the extra power you need. Buy an Auto-Lite battery—specified as original equipment by leading automotive engineers.

Auto-Lite
means
Auto-Lite

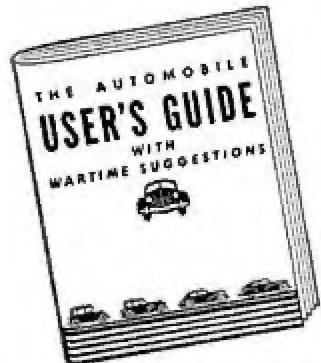


Tune in
AUTO-LITE'S GREAT RADIO SHOW
STARRING
DICK HAYMES IN
"Everything for the Boys"
Every Tuesday Night . . . NBC Network
Featuring stars of stage, screen and
radio and men and women at
the fighting fronts

AUTO-LITE BATTERIES

Will Your Car Outlast the War?

As a special wartime service to owners of **ALL MAKES** of cars, General Motors offers a new edition of **The Automobile User's Guide**, containing 196 practical suggestions on such subjects as **how to get better gasoline economy, how to prolong tire life, how to keep your car in the best operating condition, how to preserve exterior finish, etc.**



You can get your **FREE COPY** from any General Motors dealer or by using the coupon below.



Customer Research Dept., Room 1763
GENERAL MOTORS, DETROIT 2, MICH.

Please send **FREE COPY** of new 64-page
"AUTOMOBILE USER'S GUIDE"

Name
please print

Address
please print

City State

Make & Model
of Car Owned.....

the tin that once covered a crate of matches and the serrated rubber cushion of a ping pong paddle lined the handle depressor of a contact printer.

In the air, combat cameramen must be able to earn their way on a bombing mission by manning a machine gun in an emergency. Lt. James Bray, former Pathé cameraman with the 9th Air Force, who has the distinguished flying cross and the air medal with two clusters, took over when the waist gunner beside him was killed and shot down two Messerschmitts. Two Air Force cameramen were killed in filming the "Memphis Belle," a documentary color movie which showed civilians graphically what 8th Air Force crews go through on a routine mission.

The story of Sergt. Johnny Bushemi, photographer for the service magazine Yank, symbolizes the characteristic industry and bravery of American cameramen. When the American forces were about to attack Makin and Tarawa simultaneously, Bushemi chose to go to Makin but soon found he had made a mistake, for the fighting on Makin was comparatively tame. So he hitched a plane ride to Tarawa and arrived just in time to see the last stages of the great slaughter. Later he fractured his hand on Kwajalein Island and it was all he could do to operate his camera with one arm in a sling. However, he insisted on landing with the marines in the invasion of Eniwetok, where a knee mortar shell severely injured him in the cheek, neck and left leg. He died three hours later aboard a Navy transport offshore as the surgeons were tying the arteries in his neck. His last words were, "Be sure to get those pictures back to the office."

World's Biggest Jig-Saw Puzzle

Continued from page 79

from the main cockpit and cabin heating plant that the C-54 carries, a special heater is located in its nose wheel well just to provide hot air that keeps the cockpit windshield defrosted.

Even a propeller assembly, which was quite a simple unit ten years ago, is now an intricate mechanism of 1,200 different parts, balanced so delicately that a splash of paint on the tip of one blade might cause unbalance and dangerous vibration.

The jigs in which large aircraft are assembled are lined up by surveying instruments and are sighted in to an exactness of 1/10,000th of an inch to help make each airplane identical with the others of its type. Nevertheless, minute manufacturing

(Continued to page 156)

LIGHTER MOMENTS with **fresh Eveready Batteries**

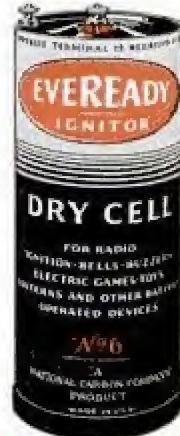


"It never fails . . . the minute I get in the bath, there goes the telephone!

"Keep your eye on the Infantry—the doughboy does it!" The doughboys are in every front line drive. Are you in on every War Bond drive?

MILITARY FIELD TELEPHONE EQUIPMENT calls for the kind of dependable power found in "Eveready" No. 6 Dry Cells.

That's why much of our production goes to the Armed Forces. The civilian supply is limited, so use yours wisely. However, after the war, there will be new and finer "Eveready" batteries...giving better service, longer life.



EVEREADY
TRADE MARK

The words "Eveready" and "Ignitor" are registered trade-marks of National Carbon Company, Inc.



GENUINE IMPORTED BRIAR

◆ Sterncrest Ultrafine . . .	\$10.00
◆ Sterncrest 14K . . .	7.50
◆ Sterncrest Sterling . . .	5.00
◆ Certified Purex . . .	3.50

CHOICE AMERICAN BRIAR

◆ Select Grain	\$2.50
◆ Silvercrest	2.00
◆ Superfine Purex	1.50
◆ Sculptured Purex	1.50

Many styles, dozens of handsome models, plain or antique finish—and all are of LHS craftsmanship

FREE—write for our new booklet, "Pointers on Pipes", chock full of pipe lore and pipe do's and don'ts

L. & H. STERN, INC., 56 Pearl Street, Brooklyn 1, N.Y.
(STERN BUILDING)

irregularities may produce slight differences in the flight characteristics of each plane. These are compensated for during the test flights by means of special trim tabs on the left wing aileron and the tail group, which are adjusted and then set permanently so that each airplane will maintain level flight with a balanced load. One item of equipment that goes with each plane is a balance computer that resembles a slide rule, by which a pilot can determine the plane's center of gravity under different load conditions.

Fuel and oil for its engine and air for the tires were about all a plane once needed. Now the servicing also includes replenishment of the hydraulic oil, fresh bottles of oxygen for the high altitude breathing apparatus and, on some aircraft, the addition of water to the plane's water tank. This water provides "war emergency power" to the engines. It spurts into the carburetor at the rate of one gallon per minute when the pilot pushes a button, supplying moisture to the carburetor air. This increases the power output and temporarily steps up the plane's speed.

The Battle Against Bacteria

(Continued from page 63)

In the 12 to 14 minutes required for complete discharge, one dispenser will fumigate 150,000 cubic feet of space, the equivalent of 240 army pup tents, or 50 giant bombers. But the spray can be turned on and off as necessary. Only three seconds are required to fumigate one pup tent.

Even sound waves have been found effective as bacteria killers. An American naval officer has invented a magnetic device which produces 9,300 vibrations a second, fatal to all bacteria within six inches.

Another group has found that chlorophyll, which gives green coloring to plants, can be dissolved in water and applied to wounds and burns as an antiseptic.

How all these discoveries are working out on the field of battle is illustrated by an incident when 561 wounded men were moved from France to England and not one of them died. In some types of wounds, the death rate would have reached 90 percent in the last war.

How the wartime developments will affect the world is likely to be startling indeed. Scientists say that people will live so much longer that countries like ours will be "old peoples" nations and our habits, politics and international relations will change as viewpoints of more elders prevail. Thus the war within a war will affect our lives in many generations to come.

AUTO-LITE SPARK PLUGS

IN SERVICE ON EVERY FRONT



"Dang it, Maw . . . Ah tol' you to let go the crank when she back-fires."

DO YOUR CAR A GOOD TURN WITH "PLUG-CHEK"

"Plug-Chek" Inspection Service is the quick and accurate way of finding the spark plugs that are wasting gas . . . it puts the finger on faulty or improper plugs, may add as much as 12% to the mileage you are now getting from your coupons, according to tests by the American Automobile Association.

Possibly all your present plugs need is cleaning or regapping — a "Plug-Chek" can give you the answer. But if new ones are needed, install ignition engineered Auto-Lites.

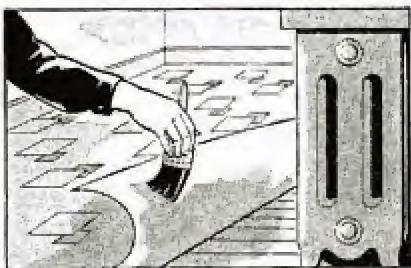
THE ELECTRIC AUTO-LITE COMPANY
TOLEDO, 1 • Merchandising Division • OHIO
BACK THE ATTACK—BUY WAR BONDS

Tune in
AUTO-LITE'S
GREAT RADIO SHOW!
STARRING
DICK HAYMES
AND GORDON JENKINS' ORCHESTRA IN
**"Everything For
The Boys"**
Tuesday Night — NBC Network
Featuring men and women of
the fighting fronts



WORKSHOP WISDOM

How to make linoleum stay down



IT'S EASY to make an excellent linoleum cement with Casco Glue. Simply mix 1½ measures of Casco with 1 measure of water.

Apply this mixture liberally to the clean floor with a heavy brush. Roll linoleum carefully over this space and place sandbags or weights on top surface to assure even pressure. Keep weights on for 12 hours or overnight.

Casco Glue wins on 4 counts

Unusual strength. Casco Glue hardens and sets chemically to form a bond of remarkable strength and toughness.

Greater durability. This glue is highly resistant to dampness, heat, and age.

Easy to mix. Casco Glue mixes easily with cold water—no heating problems.

Economical. A little Casco goes a long way. Mix it as you need it. The powder, if tightly covered, lasts indefinitely.

For special outdoor jobs and water projects, ask for Cascamite—the waterproof plastic adhesive.

You can get both Casco Glue and Cascamite in 10¢, 25¢, and larger sizes at all hardware stores.



Send for free Casco Project Booklets and free Gluing Guide containing 80 household gluing hints. Just address a post card to Casein Company of America, Dept. P2, 350 Madison Avenue, New York 17, N. Y.

CASCO Powdered Casein **GLUE**

"Sets chemically—hardens permanently"

Fitting the Gob to the Job

(Continued from page 25)

It is certain to be a battle and a grim one. To make it more complicated a group of inspecting officers runs about the ship, like expert gremlins, pulling switches and disconnecting oil lines to gum things up for the sweating crew.

An inspecting officer suddenly points at a telephone talker. "You're dead," he says. The man sits down, leaving his phone unattended. Another man grabs the telephone.

Communication between the bridge and engineroom is severed. A human chain transmits orders. A key officer is a "casualty." Another steps up.

The shakedown cruise gives every man aboard something that he can get only while operating the ship. A navy officer, just back from the shakedown of a light cruiser tells what it is:

"The one big idea you get is that the Navy is a team. You know your job—and see its importance to the team. Sure, you learned a lot in training camp. You learn more at sea. One lesson that is burned into your mind is your place on the team."

The Ether Patrol

(Continued from page 17)

locate the hidden transmitter which they now know to be in a certain small area, perhaps an apartment building.

RID operators then proceed on foot carrying a small gadget known as a "sniffer." The indicator on this device tells the operator when he is approaching the source of the signal. Authorities are then summoned.

There are many instances where signals are received in the form of high speed code. It is not possible to type the contents at a speed greater than approximately 40 words per minute. In such cases, operators in the Intercept Room make a complete recording of the transmission on a device known as a Boehme ink recorder. The speed of the tape going through the machine is adjustable. A special receiver and an electronic clipping device make it possible to record signals directly onto the tape at any speed up to 500 words per minute. The tape is then removed and placed before another operator trained to decode the contents.

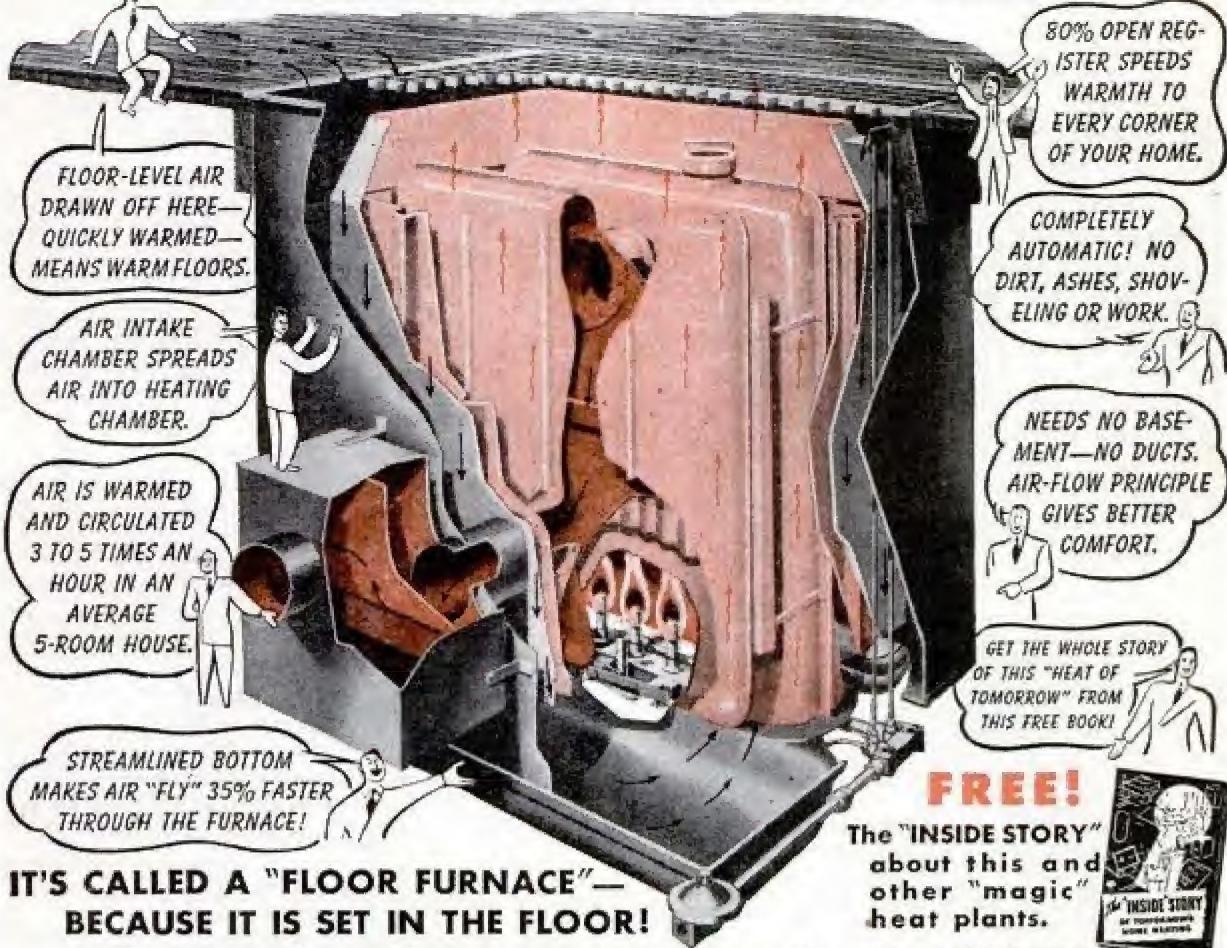
In other cases, certain aural intelligence must be recorded for study and observation. Several elaborate recorders are available and are known as Memovox disk recorders. They make use of a paper-based flexible disk which is capable of holding more than an hour's recording on each side.

(Continued to page 160)

America's Number One Manufacturer of Warm Air Heating Plants Announces

A NEW KIND OF FURNACE DESTINED TO SWEEP AMERICA!

COSTS LESS!...MORE EFFICIENT!...AMAZINGLY COMPACT!
ALREADY PROVED IN THOUSANDS OF HOMES!



IT'S CALLED A "FLOOR FURNACE"—
BECAUSE IT IS SET IN THE FLOOR!

Here is some of the practical Coleman heat-magic you can have after the war. New "warm-floor" comfort—automatic effortless ease—surprisingly low fuel cost. One of a group of advanced heating plants, perfected by Coleman engineering genius. Gas, oil, butane models will be available.

FREE!
The "INSIDE STORY"
about this and
other "magic"
heat plants.

A book of solid facts about the different type of heating that will be available when production is resumed. Mail coupon for your copy, to Coleman Lamp and Stove Co., Dept. PO-626, Wichita 1, Kansas.



THE "HOT" NAME
IN HOME HEATING

Coleman

THE COLEMAN LAMP & STOVE CO.,
Dept. PO-626, Wichita 1, Kansas.

Without obligation, send me your **FREE** illustrated book,
"The Inside Story of Tomorrow's Home Heating."

Name _____

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Town _____ State _____

THE COLEMAN LAMP AND STOVE COMPANY
WICHITA 1 • CHICAGO 11 • PHILADELPHIA 8 • LOS ANGELES 54

Night shift or day shift, the steelworker's car must be always ready. Thousands of those "front line" workers insure utmost reliability in spark plug performance by having their plugs cleaned and adjusted every 3,000 miles, and by replacing worn plugs with new AC's. That's a good rule for everybody, because it saves gas, oil, and vital materials for an earlier Victory.



**BRING YOUR FIGHTING MAN HOME SOONER
BUY ANOTHER WAR BOND THIS MONTH**

Another often used device is a Telecord wax cylinder recorder. RID mobile units carry them so they may record transmissions which they have under observation.

One of the most important wartime functions of the RID is the locating of lost aircraft. Requests are made daily to search for both private and military craft, and hundreds of them have been located and guided to landing fields. In peacetime, the RID will continue this important function.

America can well be proud of her amateur radio hobbyists. Without this trained personnel it is doubtful such an efficient organization could have been set up almost overnight.

Trouble Shooting in the Sky

(Continued from page 31)

lows the wheels to fall by gravity into landing positions, where they lock in place. Now he is able to land but he still has the problem of bringing the plane to a stop, possibly on a short runway. First he tries to pump up the hydraulic pressure in the brake system by means of an auxiliary booster pump. If this doesn't work he lands anyway and then, at the point on the ground at which he wants to apply the brakes, he pulls a toggle that releases compressed air into the braking system's hydraulic lines. The air slams on the brakes and stops the plane.

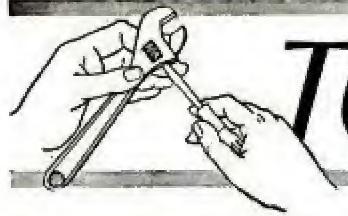
The testing of a new plane is a methodical job. First comes a complete pre-flight check by the ground crew. When any apparent troubles have been remedied, the plane gets a personal inspection by a pilot. Satisfied, he starts the engines, checks his instruments, and begins writing answers to the scores of questions on his check sheets. Instrument readings during the takeoff must be remembered and written down as soon as he gains a comfortable altitude. Then he cruises at slow speed because the engines are new and must be broken in gradually.

Any malfunctions are remedied after he lands and then the plane gets a second test flight to make certain that the reworked items are operating properly. Soon after, the plane makes its third flight, the acceptance flight on which it is turned over to the military service that will use it.

Included in the production flight test department is a special corps of flyers who roam over much of the world, doing trouble shooting for the armed forces and teaching military pilots how to get the best performance out of the Douglas planes.

Chief among these traveling pilots is

(Continued to page 162)

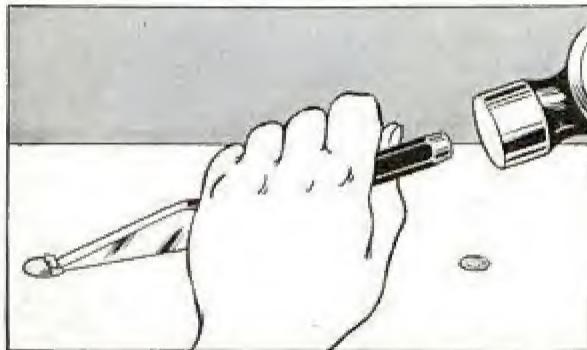


TOOL NOTES

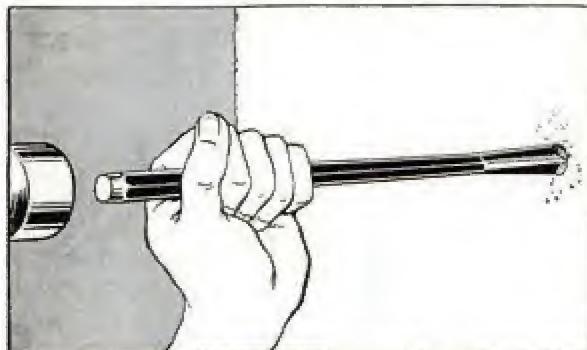
Maintenance
and Repair
Suggestions to
Prolong Tool Life

No. 19 PICKING THE PROPER TOOL FOR THE JOB

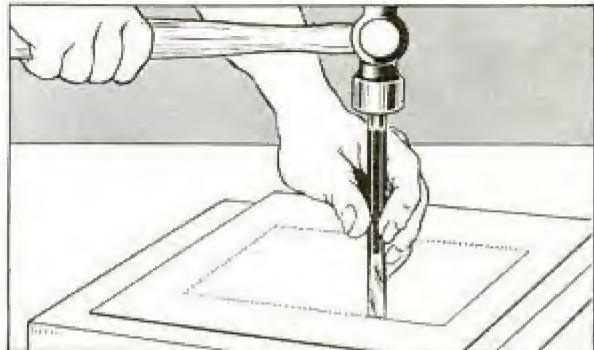
A few simple rules will help in selecting the proper cold chisel or punch. In making your selection, remember this basic rule: cold chisels are designed to cut only metals softer than the tool itself. Use a heavy hammer; a light hammer won't transmit the force of the blow to the cutting edge.



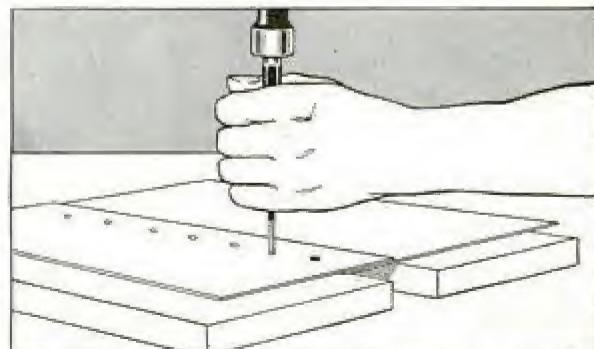
Probably the easiest way to remove a rivet head is to use a Crescent Cape Chisel, as illustrated. Cut through center section first, then knock off the two side wings.



A Crescent Star Drill is the proper tool for making holes in concrete or other masonry. Give the drill a quarter turn after each blow with a heavy hammer. In a pinch, a cold chisel will suffice but work is slower.



Use a Crescent Cold Chisel to cut sheet metal with a back plate. First scribe the line or design and with sheet laid on back plate, cut as illustrated. Finish edges with a file.



Use a Crescent Pin Punch to drive out a rivet or pin. Select a punch having a diameter slightly less than that of the rivet. A point too small may upset the end of a soft rivet and make it seize.

MAIL THE COUPON FOR FREE REPRINTS



This is No. 19, in Crescent's TOOL NOTES Series. These informative advertisements provide practical information for users of hand tools.

CRESCENT TOOL COMPANY, JAMESTOWN, N.Y.

Crescent Tool Co., Jamestown, N.Y. I-6

Please send your "Tool Notes" Series
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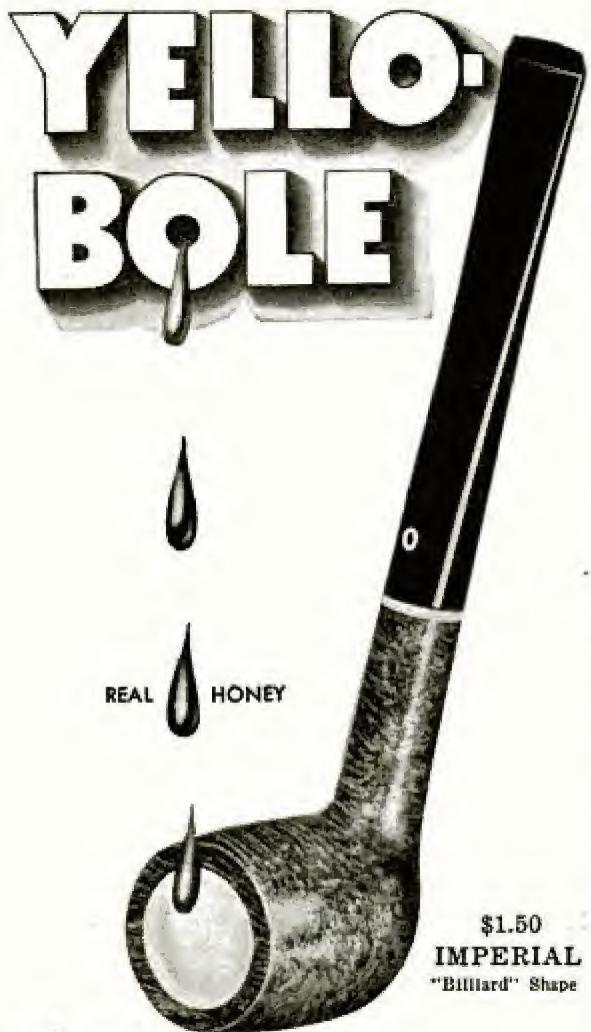
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CRESCENT TOOLS

Give Wings to Work



the honey-cured smoke

There's a truly wonderful flavor and aroma from the honey, as it blends gently (just enough) with your tobacco. It took years of patient work to get this flavor right, and ever since 1933 Yello-Bole has been among the most popular and favored, of pipes. Agreeable, and *mild*, even the first pipeful. The pipe-bowls are made from real burls, not lumber. If your dealer doesn't have Yello-Boles now, he should have them soon. Men in service all over the world, are getting Yello-Boles first. But yours will be there shortly.

- * **YELLO-BOLE IMPERIAL \$1.50**
- YELLO-BOLE PREMIER \$2.50**
- YELLO-BOLE STANDARD \$1**

YELLO-BOLE A NAME TO REMEMBER, WHEREVER YOU ARE—
AND WHEN YOU COME HOME

Benny Howard, who averages more than 10,000 miles in the air per month. On one trip he flew from the United States to Australia in 40 hours, made a side trip to New Guinea to deliver spare parts, and was back in California one week from the time he started. Howard jumps to Scotland for a conference, makes a side trip to Casablanca to show Army pilots how to carry heavier loads in their C-54's, and yet spends more than half of his time at the main Douglas plant. During the last few years he has traveled half a million miles by air.

Monsoon Salvage

(Continued from page 43)

the P-40 took shape rapidly and one rainy morning, an ASC took her up. Diving her, split-S-ing her, throwing in a few chandelles, he satisfied himself that this fighter was "as good as new." A radio went to Col. Cochran's executive officer: "Mission accomplished."

"We like to get 'em in good enough condition to make 'em flyable again," Colonel West commented. "Some are just too inaccessible to pull out like this one. If that happens, or if it's a wreck, we go in anyway with coolies and pack out all salvageable parts. Our boys are mighty proud of their 'keep 'em flying' job. They deserve all the praise in the world, and the fighter and bomber pilots are the first to give it to them. Air Service Command is part of a wonderful team, a real American team that guarantees victory."

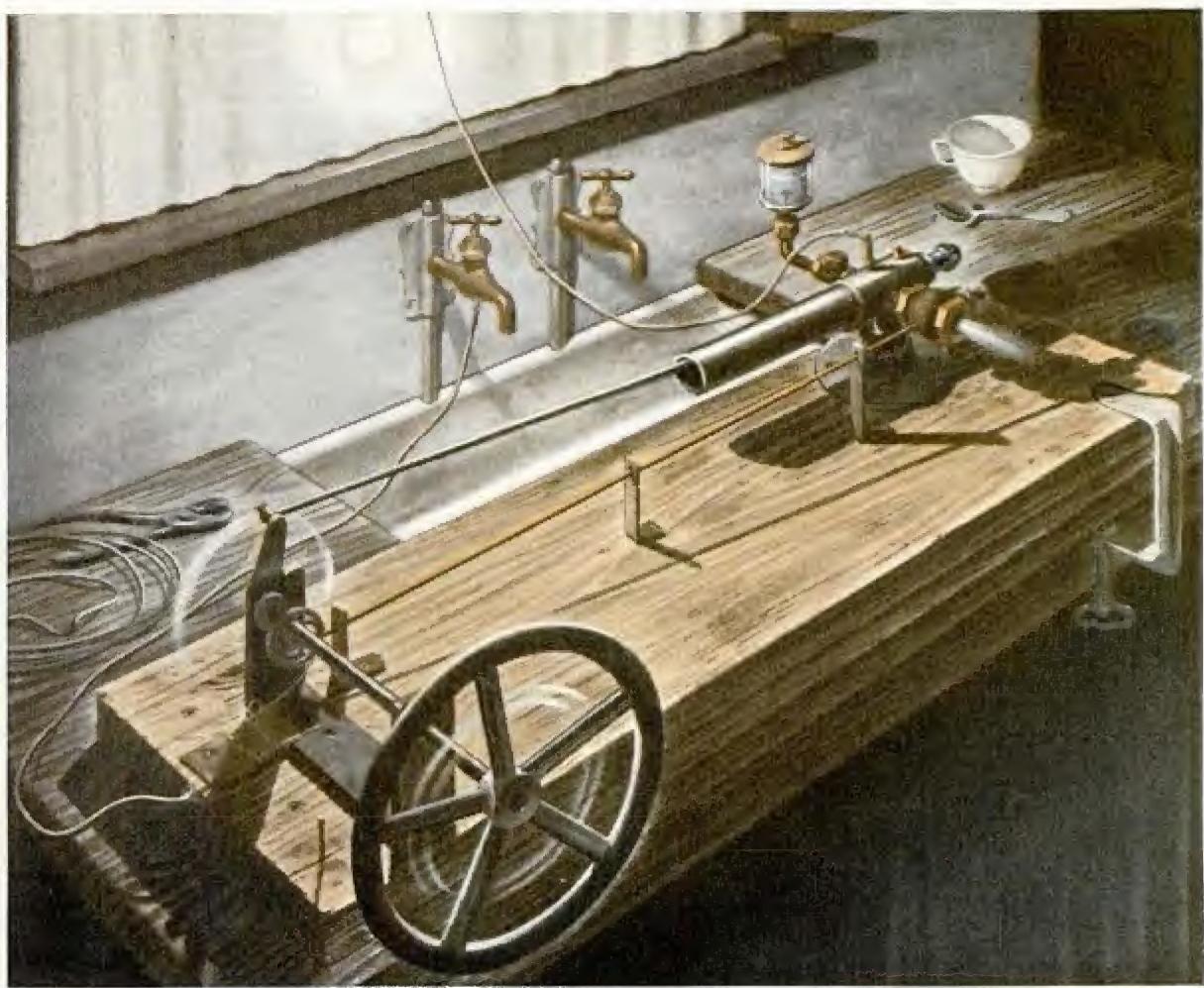
Hurricane in Harness

(Continued from page 4)

40 to 50 pounds per horsepower, compared to a weight range of 100 to 300 pounds per horsepower on conventional ship engines. Accordingly, a Liberty ship could carry 1,000 tons more cargo, if gas turbine powered, and attain more speed. Construction of several marine gas turbines for cargo ships and tankers has started in the United States.

Its lightness and compactness make the gas turbine ideal for use as a fairly small stationary power plant. For example, Brown, Boveri's 4,000-kilowatt, bombproof standby generating plant occupies only 34 percent of the space a comparable steam turbine would, with at least equal efficiency. Twenty-seven gas turbines have been installed in this country to assist in the Houdry catalytic cracking process of making 100-octane gasoline for the nation's warplanes. Without this "boxed hurri-

(Continued to page 164)



In the Ford kitchen . . . this little trial engine sputtered into life

IT HAPPENED far back—in the very early 1890's. In the kitchen of his Detroit home, a young engineer, named Henry Ford, was testing a principle of the internal combustion engine.

His apparatus, clamped to the kitchen sink, was a piece of one-inch gas pipe, reamed out for a cylinder—the flywheel, a hand-wheel from a lathe. Gasoline was fed from an oil cup. A wire connected to the kitchen light furnished the spark.

He spun the flywheel. Flame came from the exhaust, the sink shook and the trial engine was running under its own power. Mr.

Ford was satisfied. He put the engine aside. It had served its purpose. His idea was proved.

But he did not stop to applaud himself. "The man who thinks he has done something," Mr. Ford once said, "hasn't even started." His mind was already stirring with thoughts of a new and larger engine for transportation use.

Just ahead lay the pioneering which was to produce the Ford automobile of world-wide use. Ahead lay the creation of the first industrial assembly line, hundreds of inventions and improvements, the building of 30,000,000 low-cost motor cars and trucks to

serve the needs of all the people.

Today, at Ford Motor Company the pioneering still goes forward. New methods, new materials, new devices are continually being developed. You don't hear about many of them, because Ford assignments now are military.

But one day the story of this modern pioneering can be told. It will be told, you may be sure, through the medium of Ford, Mercury and Lincoln cars so advanced in both style and engineering that new millions will seek to own them—for comfort, for smartness, for reliability, and for economy.

FORD MOTOR COMPANY





POOR RICHARD wrote a good hand!

Benj. Franklin won fame with his Almanac . . . in later life was twice ambassador to England, once to France. A clear thinker, he took pride in his clear penmanship. In his Autobiography, he said, "I learned to write a good hand."

Our present foreign envoys in the AUS—hundreds of thousands of them—may write poorer hands, but have better pens . . . Many treasure an Inkograph . . . the precision instrument of penmanship. Sturdy and speedy-acting, with smooth flow of ink, it is built to write millions of words.

The needs of service men come first, so if your dealer is out of stock—keep trying. Sorry, no mail orders—only dealers can supply you.

Use any pen to sign up for more
WAR BONDS!

INK-O-GRAF \$2
Inkograph Co., Inc., 200 Hudson St., N.Y.C. 13



cane," a motor requiring 5,000 to 6,000 extra horsepower would be needed to power the compressor in the Houdry process.

Many problems, however, remain to be solved in the development of gas turbines for heavy, continuous-duty jobs. Problem No. 1 is finding materials which will remain stable even at glowing temperatures.

"Gas turbine engineers foresee the time, as temperatures go higher and higher, when the only suitable materials for the task may be both too hard to machine and too brittle to forge," says J. K. Salisbury, General Electric turbine engineer. "That will require new ways to form and shape metals. A possible solution can be borrowed from dentistry—in which minute gold fillings must be cast to intricate shapes with virtually no dimensional error.

"Use of such methods—direct casting of turbine parts to their ultimate shapes and dimensions, so that they require no further shaping or forming—will enable use of the metals needed to withstand high temperatures that will give high gas turbine efficiencies."

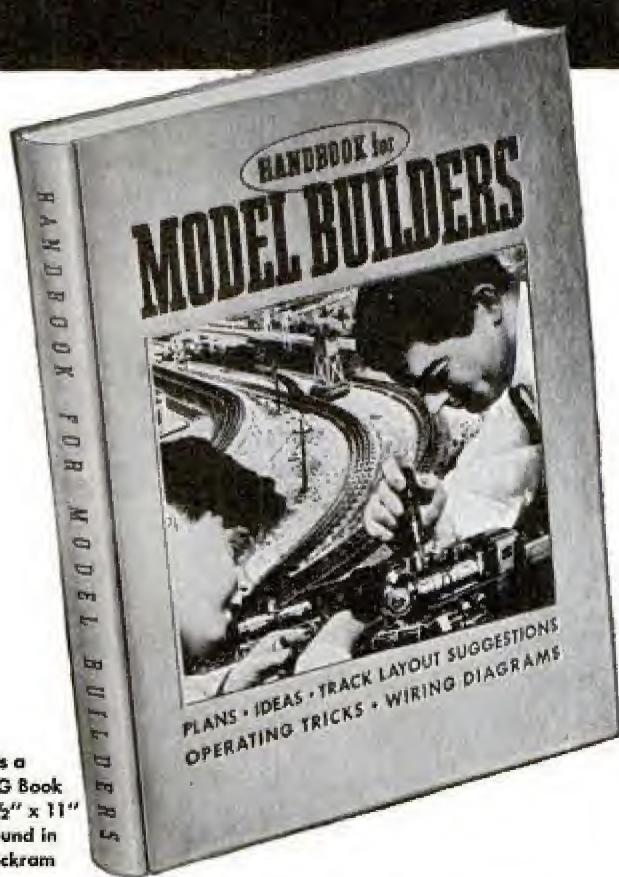
Another shortcoming is the fact that the turbine seems limited to power plants requiring from 1,000 to 10,000 horsepower. Because of the large volume of air needed, Salisbury sees it as a reliable prime mover of intermediate capacity for the present, rather than as competition for large steam turbines used in central power stations. Also, while it will be powerful enough to drive airplanes, ships and locomotives, it probably would be delicate, costly and inefficient if it were built small enough to power automobiles.

Oil and Coal Made From Plants By Pressure-Heat Process

Sugar cane, potatoes, and even weeds are transformed into crude oil and coal by a pressure and temperature process. This shortcut, which does the work it takes nature some millions of years to perform, was developed in the laboratories of the Carnegie Institute of Technology by Prof. E. Berl. The process, which may solve the world's fuel problem for all time, involves the use of alkalis derived from limestone, dolomite and zeolites. In the natural conversion of carbohydrates to crude petroleum, Prof. Berl believes these alkalis were present in large amounts. It would take only 2.1 percent of the land available to grow sufficient starchy or fiber crops to provide gasoline and oil for America's automobiles, according to Prof. Berl. This would amount to 55,600,000 tons of liquid fuel a year.

American Chemical Society
in Cleveland, Ohio
POPULAR MECHANICS

This is the Time TO PLAN YOUR MODEL RAILROAD



It's a
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8½" x 11"
Bound in
Buckram

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THAT WILL HELP YOU**

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PUBLISHED BY LIONEL

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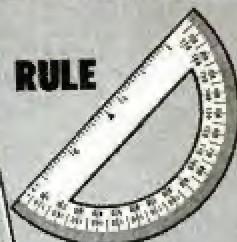
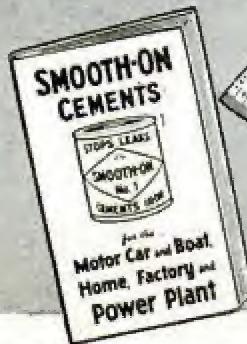
Pictures, plans, blueprints, facts, figures and instructions that tell the complete story of model railroading from the ground up—show you what to do to build a train set into an extensive operating system—how to plan a layout that will look like a real railroad—how to build an elevated division, a miniature lake, river or waterfall—how to ballast the roadbed—how to operate trains accord-

ing to real railroad practices and make them duplicate everything that real trains do. **BEST OF ALL**, the Handbook shows you what you can do NOW so that you will be ready when the war is over and Lionel Trains are again being made. Clip and mail the coupon below, enclosing One Dollar in check or money order. A copy of the Handbook will be sent to you by return mail.

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HANDBOOK

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- 2 The 40-page, pocket size Smooth-On Handbook, showing how to make dozens of necessary home repairs, with Smooth-On Iron Cements. 170 diagrams. Clear, concise directions. Conveniently indexed.

What the Handbook Shows

This repair handbook shows how you can SEAL CRACKS in furnace, boiler, stove, water heater, radiators, piping, auto crank and gear cases, water jackets, etc. . . . STOP LEAKS at seams, threaded or flanged joints, bolts, rivets, etc. . . . TIGHTEN loose screws, bolts, handles, pulls, casters, fixtures, etc. on tools, utensils, furniture . . . WATERPROOF wet cellars, concrete, brick or stone floors, walls, cisterns, troughs, tanks, pools, etc.

Your neighborhood hardware store handles Smooth-On Cements. Easy to use. Require no heat. Make durable repairs. Get a can of Smooth-On today. And be sure to mail the coupon before our limited supply of protractors is gone.

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"It's miraculous how these HARLEY-DAVIDSONS stand up!"

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"It's miraculous how Harley-Davidsons stand up under combat conditions. We have a stretch of road 35 miles inland and there isn't a road in the states that could be half as bad. Dust about 6 inches deep, and hills so steep that locked wheels won't hold when we stop. That's where power is needed and a good sturdy machine. I even forded streams where the water was swirling around the air cleaner — and she kept running. It's a new deluxe Harley-Davidson for me after the war. It's a great motorcycle!"

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With **SMOKEMASTER**, you
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All of us telephone people sincerely appreciate your patience and understanding in this war emergency.



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... the pin for HER . . . the ring for HIM
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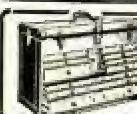
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OUTDOOR MEN!
Don't suffer from
CHAPPED LIPS!



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Get LYPSYL Now!

When lips are chapped, cracked, painful, just rub on this colorless pomade. Lypsyl soothes and promotes healing. Equally good for dry, parched lips. Helps cracked, broken skin to heal. Applies in a jiffy. Get a tube for every member of the family. Costs only 25c. If your druggist is out of Lypsyl, send 25c and coupon below for prepaid tube.

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No chapped lips for me. Rush along my Lypsyl, prepaid,
25c for each tube.

Send me _____ tubes. (PRINT PLAINLY)

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Watch Crystals You CAN'T BREAK



PROTECT YOUR WATCH

A watch with a broken crystal is useless. Go to any jeweler—ask him for a G-S FLEXO CRYSTAL 100% BREAK-PROOF. Fitted while you wait. Any size. Any shape. **Guaranteed.** GERMANOW-SIMON MACHINE COMPANY, Rochester, N.Y.

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Volts ... Quickly!
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Problem solved
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...THE WISE WAY IS PERIODIC RECHARGES!

GAS rationing means restricted driving . . . and that's bad for your battery. But don't let your battery go "dead." Drive in to your Exide Dealer occasionally for a FREE CHECK UP! When necessary, he'll advise a recharge which will keep your battery strong. PERIODIC RECHARGES cost little, but they postpone the day when you'll need a new battery. When you *must* buy, get a dependable, long-lasting Exide. Buy to Last—Save to Win.

THE ELECTRIC STORAGE BATTERY CO.
Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

EXIDES ARE USED IN MORE THAN 100
APPLICATIONS BY OUR ARMED FORCES



- 1 Don't buy *anything* you can do without.
- 2 If you **MUST** buy, insist on dependable, long-lasting merchandise.
- 3 Take care of the things you have. *Make them last!*
These conservation rules save materials for war production, help curb inflation, give you more money to invest in War Bonds.

SPEECH UNDERSTANDING TEST

FOR THE HARD OF HEARING



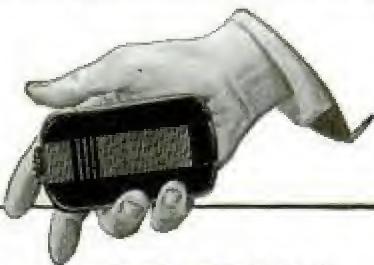
There's a big difference between hearing and understanding! Try this test, with and without your hearing aid. Have sentences read aloud, speaker 12 feet away, lips concealed. Check your scores.

RIGHT WRONG

✓ ✓

1. Is the sun larger than the earth?	
2. Name the tree on which bananas grow	
3. Explain the purpose of fire drills	
4. Name a state which has no seacoast	
5. Explain why a corked bottle floats	

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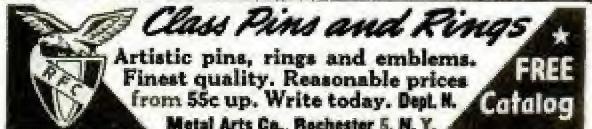
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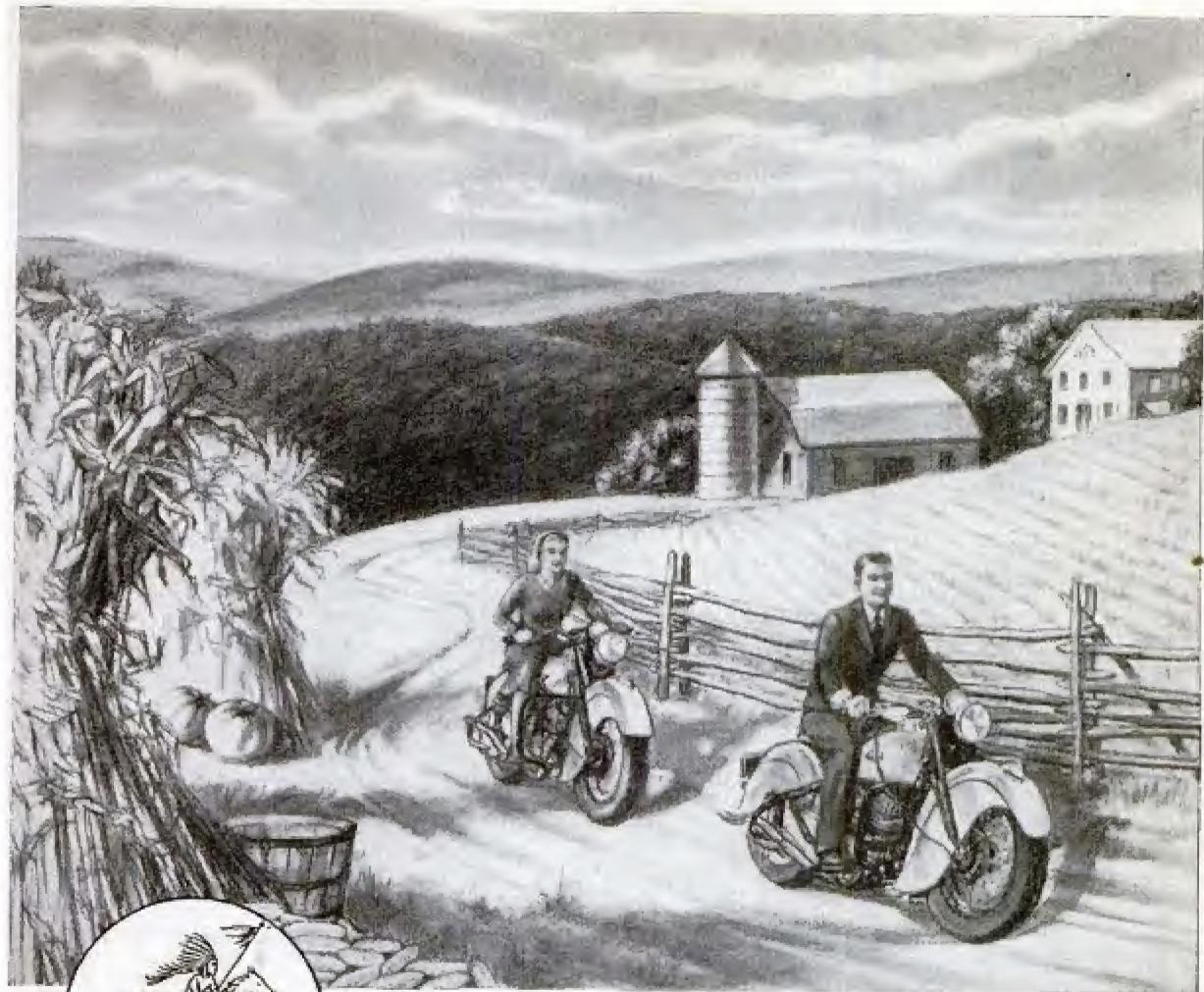
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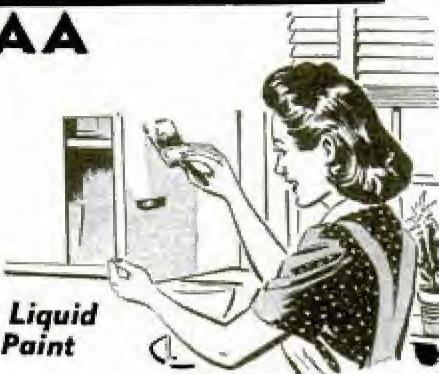
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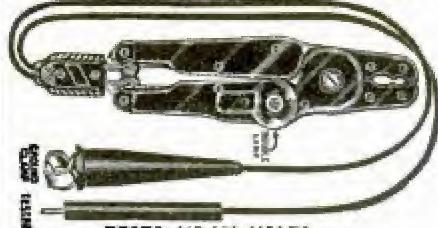
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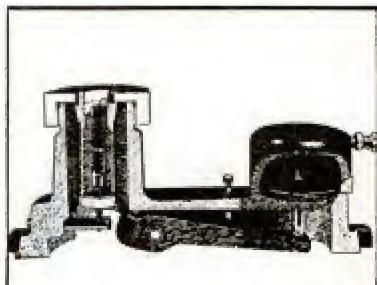
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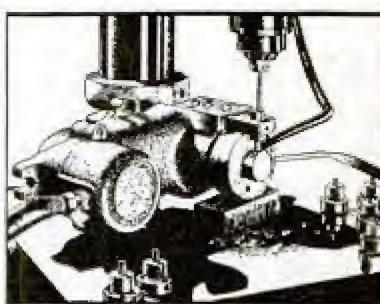
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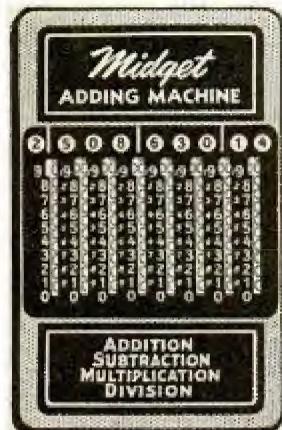
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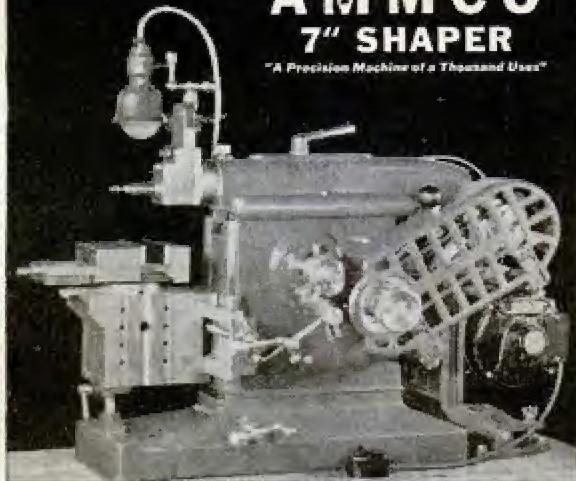
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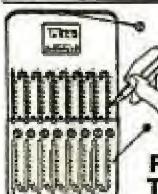
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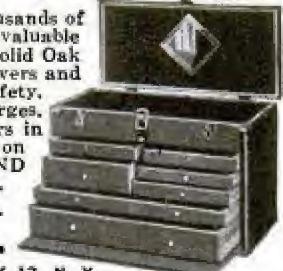
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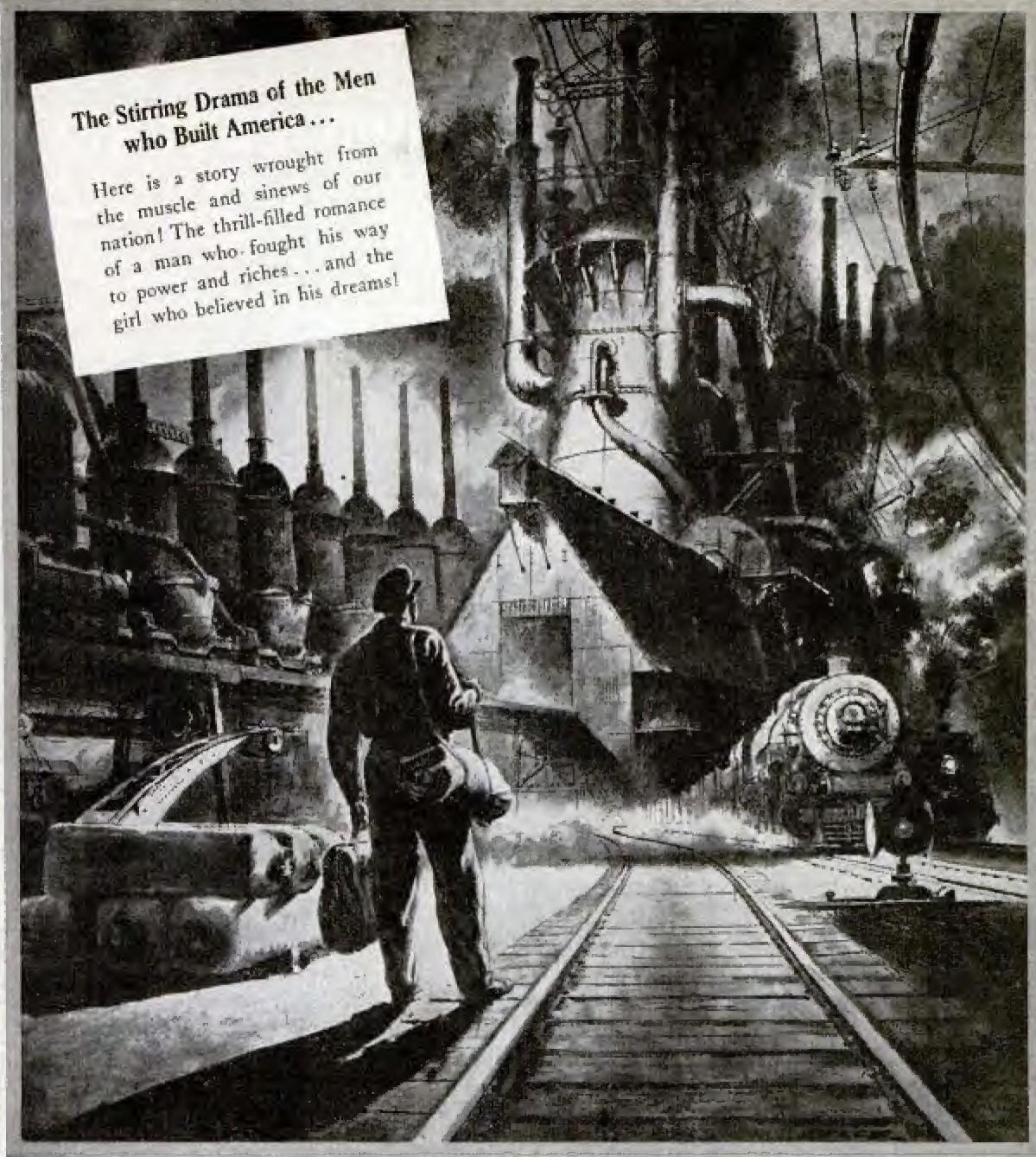
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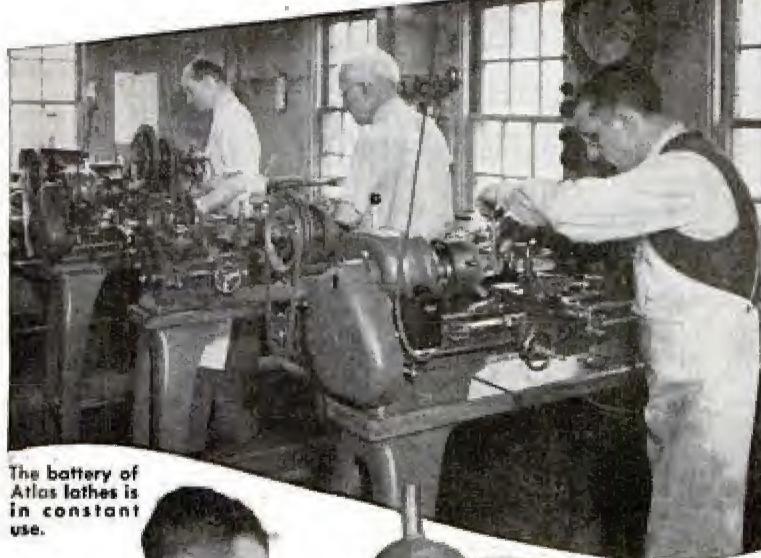
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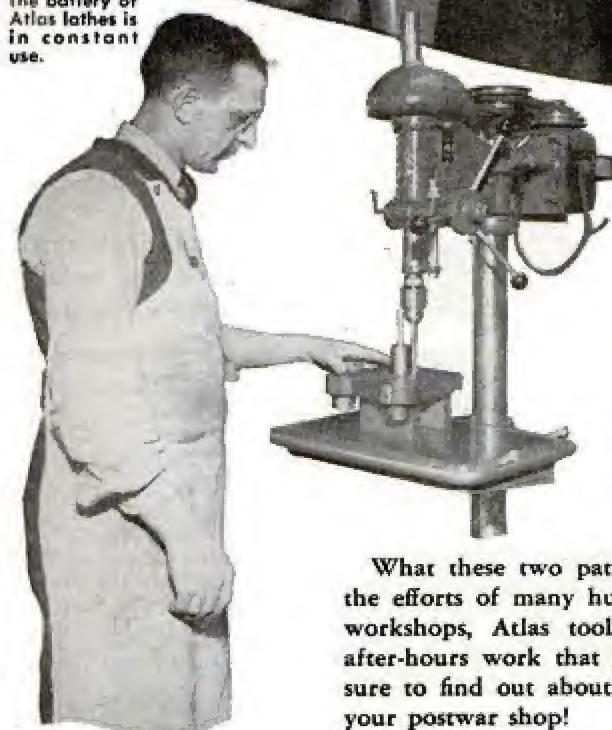
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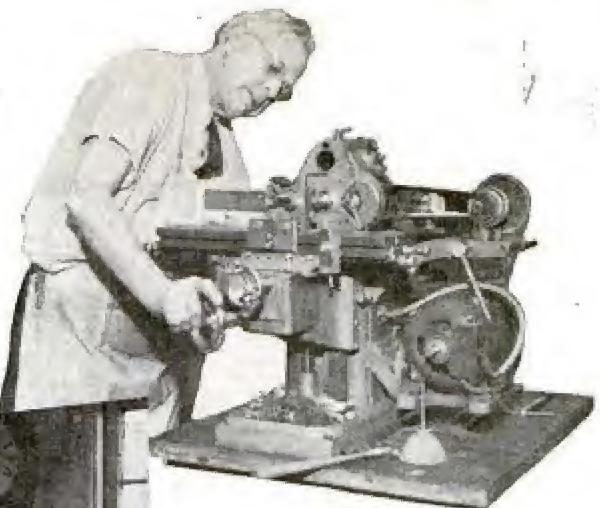
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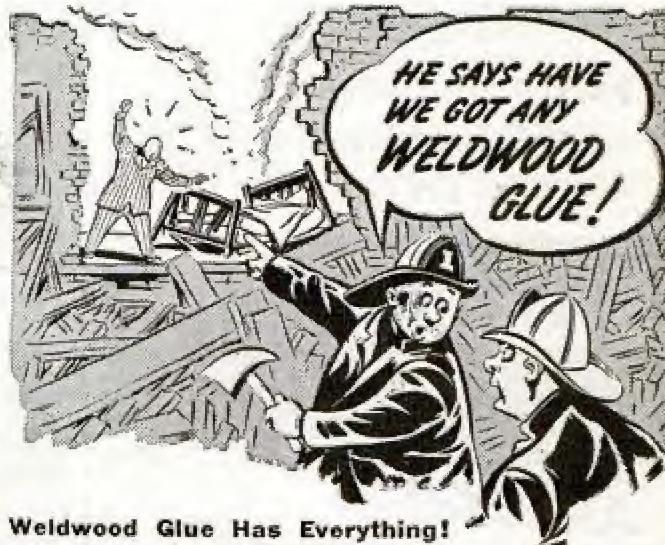
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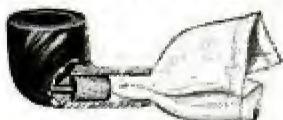


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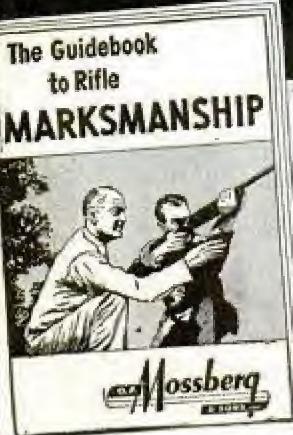
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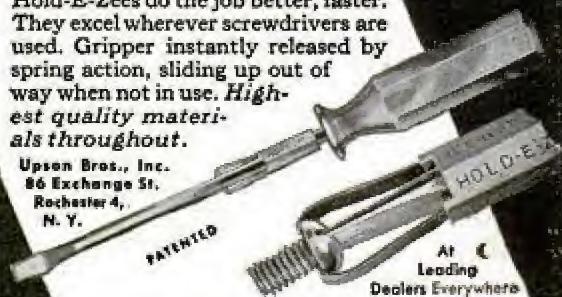
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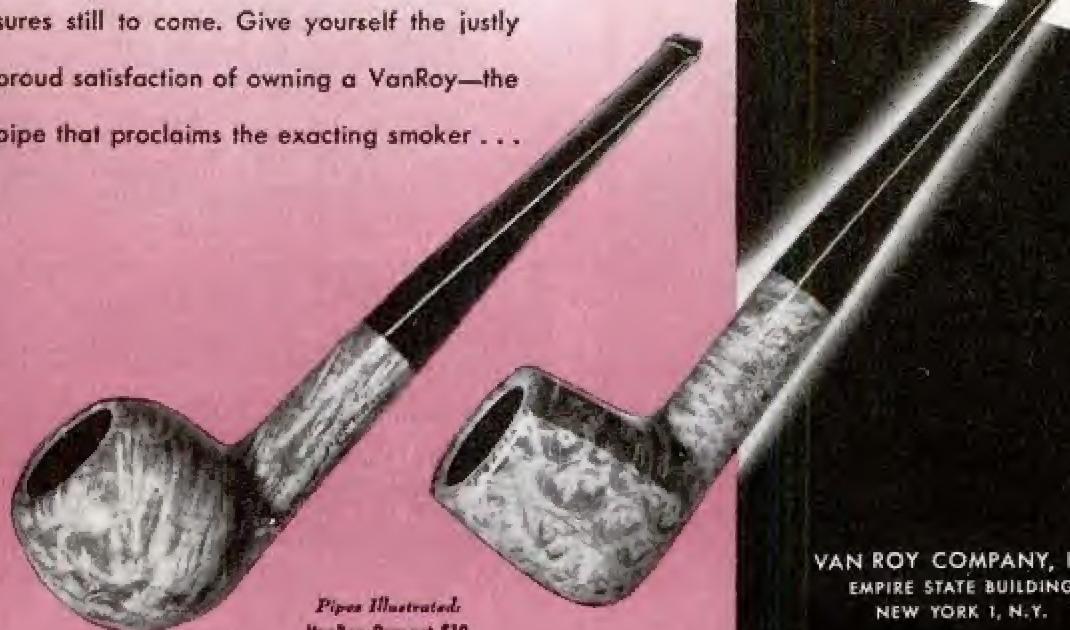


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NOVEMBER, 1944

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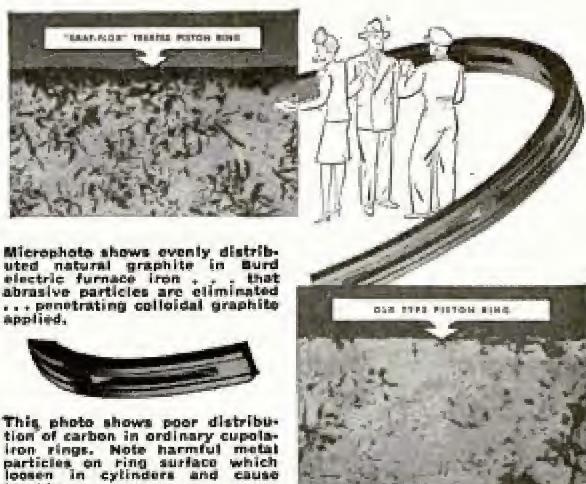
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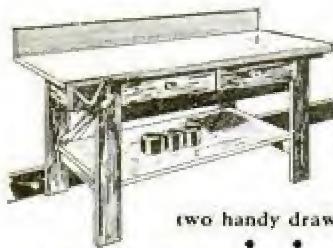
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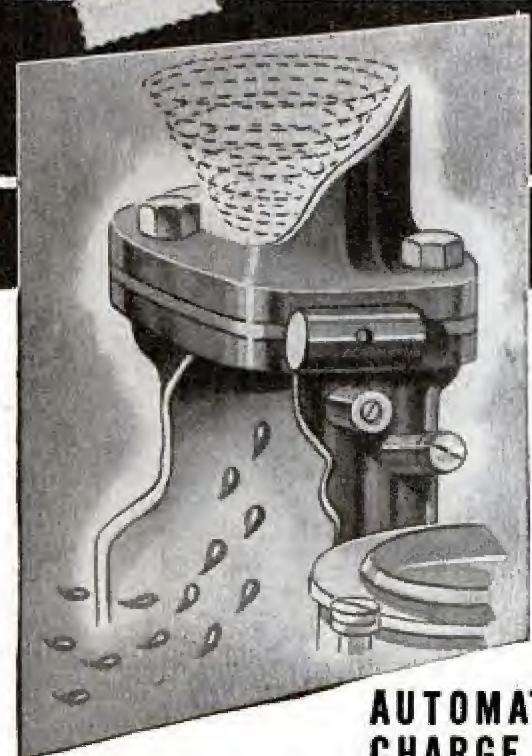
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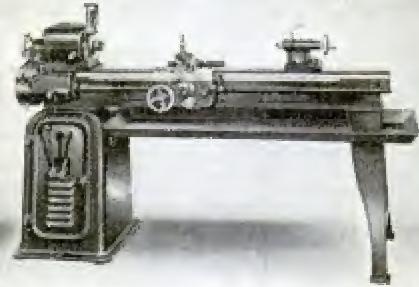
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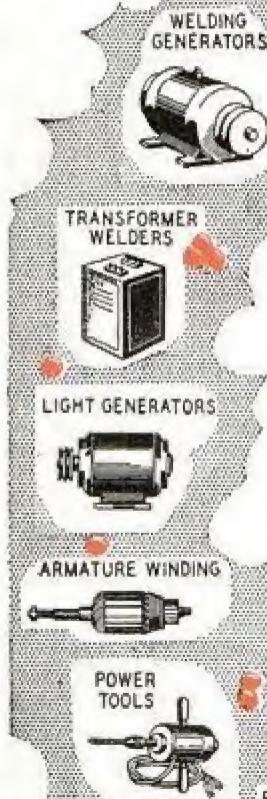
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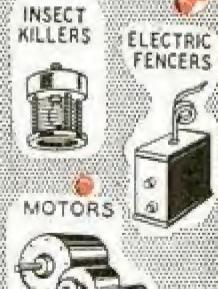
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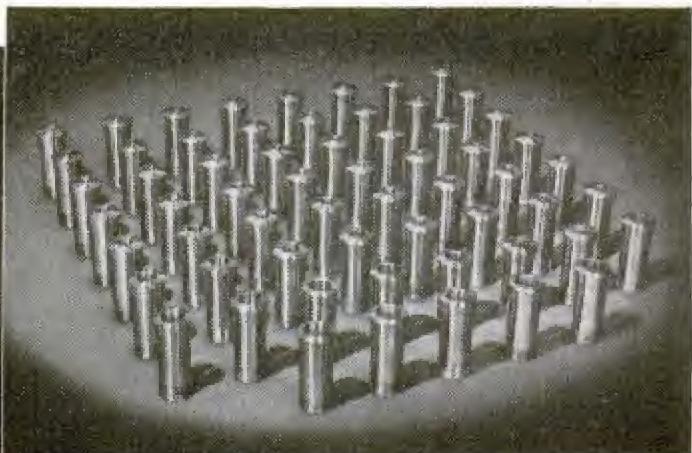
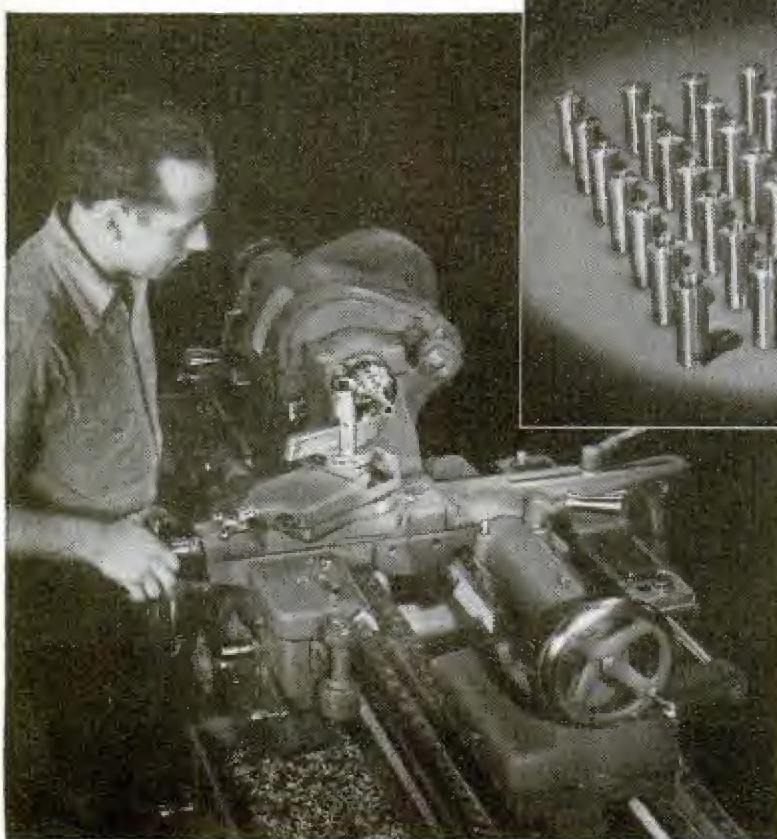
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BECAUSE of the tremendous demands of our Armed Forces and Lend-Lease for "Prestone" anti-freeze, there has been a reduced supply available for civilian use this season.

The War Production Board, with the assistance of the Anti-Freeze Industry Advisory Committee, worked out a state allocation distribution plan for all types of anti-freeze this year. Under this arrangement there should be a sufficient supply of anti-freeze to go around. Yet, there may be many localities where "Prestone" brand anti-freeze is unavailable.

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That's Camels! Cool, extra-mild—with a full-flavored appeal that never wears out its welcome. No matter how many you smoke, Camels don't go flat. Camels always taste fresh . . . good! If you're not already a Camel smoker, try them today. Let your own taste tell you the meaning of the words, "I'd walk a mile for a Camel."

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